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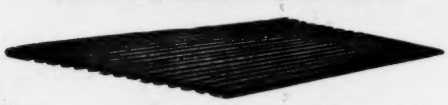

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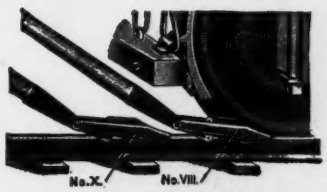

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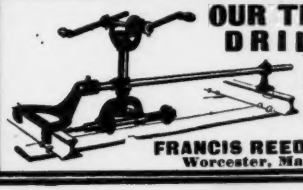

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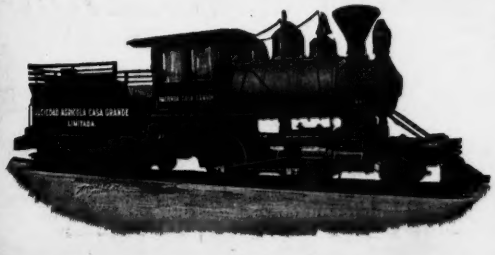

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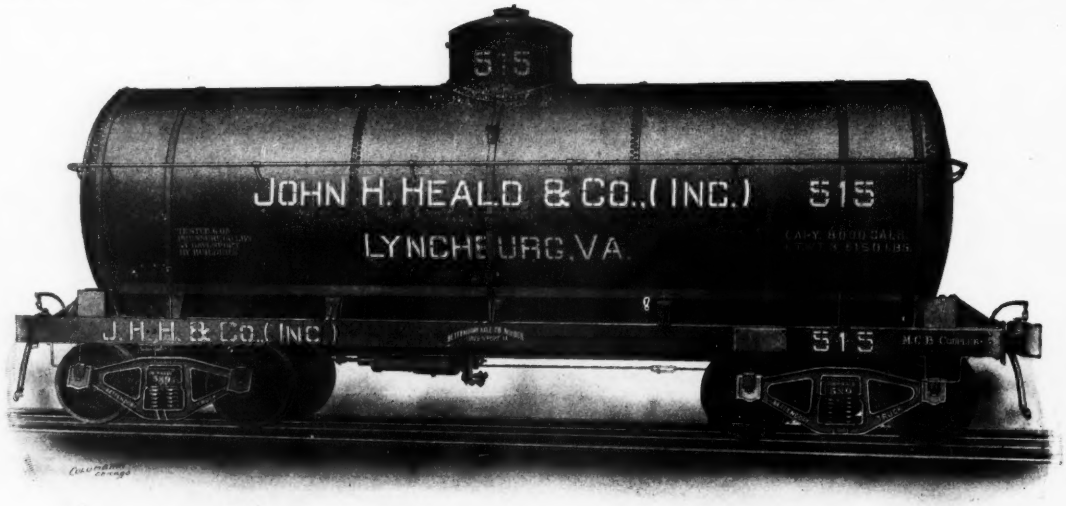

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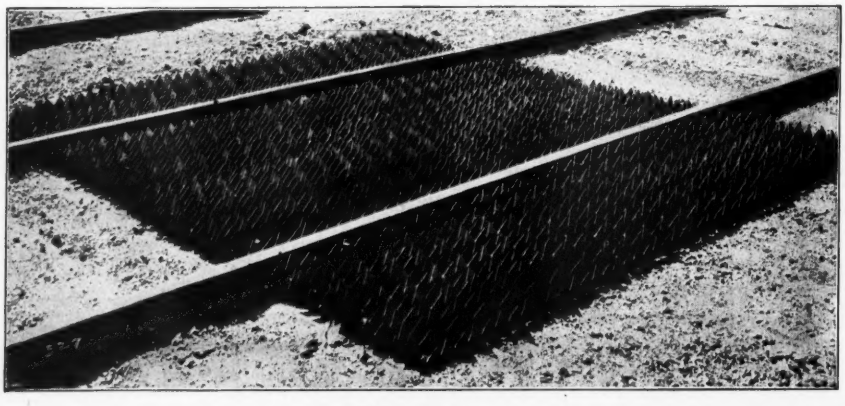

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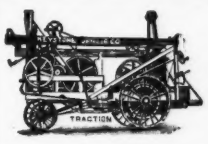

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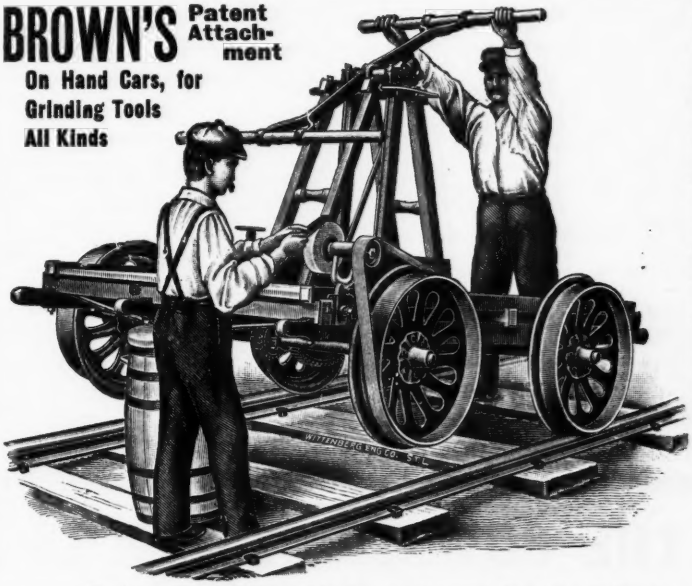

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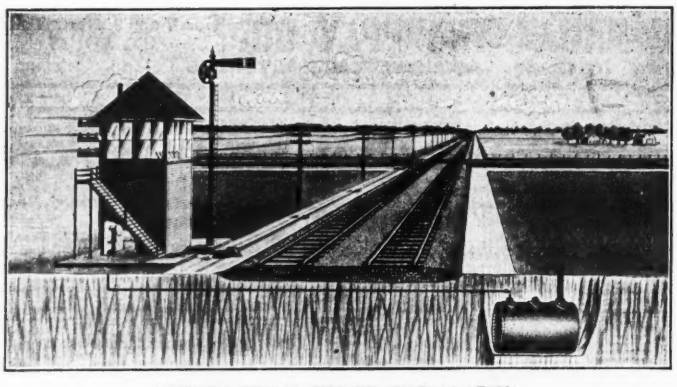

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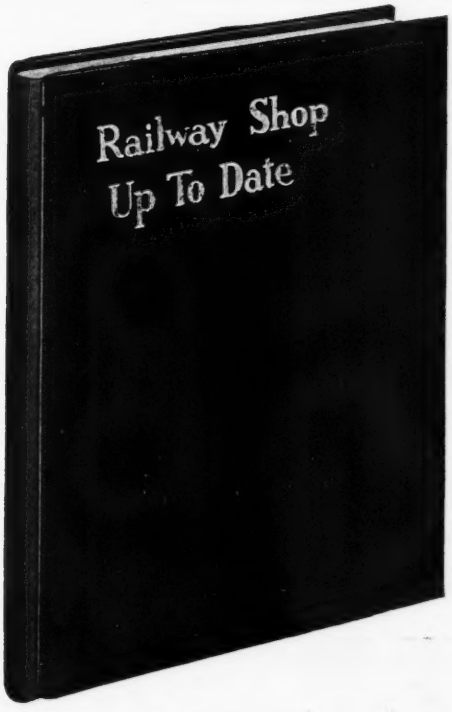

This is a book of nearly 250 pages 9x12 inches in size and filled from cover to cover with the practical every day knowledge every railroad engineer ought to have. It has been carefully compiled from all that is known and has been written about the best and most representative railway shops in this country. Every large shop having up-to-date and valuable features, is described. Many of these shops are completely illustrated with cuts made from the drawings of the shops in the possession of the railroads. It is written in a clear and lucid style. It gives inside knowledge that is of inestimable advantage to every Engineer.

It is the best authority on railroad shop practice, construction and design published and ought to be in the hands of every man who expects to advance in his work.

This book is handsomely bound as you will note from the photographic reproduction shown herewith. It contains not only a vast amount of valuable information in regard to each of the big railway shops but also gives the kind of tools used in each and the best arrangement, with best practices and methods of construction and design. There is no doubt but that you will find many things in this book which will materially aid you in your work and by reference to it you will find improvements that can be made in your shop or your department that will increase its efficiency and capacity.

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Railway Engineering

and Maintenance of Way

Mr. E. E. Grist, assistant general foreman of the Ft. Wayne shops of the Pennsylvania, has been appointed assistant master mechanic, with office at Ft. Wayne, Ind. Mr. Grist will be succeeded as assistant general foreman by Mr. A. S. Courtney.

Mr. W. F. Ackerman has been appointed shop superintendent of the Havelock shops of the Chicago, Burlington & Quincy, vice Mr. F. Kroehler assigned to other duties.

Mr. Wilson E. Symons has been appointed superintendent of motive power and machinery of the Chicago Great Northern, in charge of shops and machinery and the care and maintenance of locomotives, cars and other rolling stock; with headquarters at St. Paul, Minn. Mr. W. P. Chrysler will remain in the service as assistant superintendent of motive power and machinery, with headquarters at Oelwein, Iowa.

Mr. Harry Santee and Mr. A. B. Dennison have been appointed assistant road foremen of engines on the Buffalo division of the Lehigh Valley. Mr. Santee will have charge of the freight engines and Mr. Dennison of passenger engines.

Mr. Malcolm Baxter, master mechanic of the Western Ohio Railway, has resigned.

Mr. J. F. Leonard, general inspector of signals of the Chesapeake & Ohio, has resigned to go into the railway and electrical supply business at Richmond, Va.

Mr. W. H. Fenley has been appointed the signal engineer of the Chicago Great Western, succeeding C. A. Christofferson.

Mr. E. V. Williams has been appointed a general foreman, locomotive department of the New York Central & Hudson River, with office at Avis, Pa., succeeding H. B. Whipple, promoted.

Mr. E. H. Hohenstein has been appointed a general boiler inspector of the Chicago, Rock Island & Pacific, with office at Horton, Kan., succeeding Mr. W. B. Embury, assigned to other duties.

The jurisdiction of Mr. Charles H. Cartlidge, the bridge engineer of the Chicago, Burlington & Quincy for the lines east of the Missouri river, has been extended over the lines west of the Missouri river.

Mr. E. J. Bohanon has been appointed a roadmaster of the Chicago, Rock Island & Pacific, with office at Little Rock, Ark., succeeding Mr. Austin Ball, resigned.

The offices of the roadmaster and the assisant superintendent of bridges and buildings of the Chicago, Lake Shore & Eastern were removed to Gary, Ind.

Mr. George Boyce has been appointed the superintendent of telegraph and signals of the Chicago, St. Paul, Minneapolis & Omaha, with office at St. Paul, Minn.

Mr. T. A. Lawes has been appointed the master mechanic of the Southern Indiana and the Chicago Southern, with office at Bedford, Ind., succeeding Mr. G. A. Gallagher, resigned.

Mr. A. M. Kinsman, engineer of construction of the Baltimore & Ohio, has been appointed the chief engineer, with office at Baltimore, Md., succeeding D. D. Carothers, deceased.

Mr. G. L. Moore has been appointed engineer of maintenance of way of the Lehigh Valley, vice Mr. R. G. Kenly, resigned.

Mr. Robert Burgess has been appointed chief engineer of the Hondurus National R. R., with headquarters at Truxillo, Honduras, Central America.

Mr. W. S. Hawlings, of Pawhuska, Okla., has been appointed chief engineer of the proposed Oklahoma & Golden City R. R., surveys for which are now under way.

Mr. W. H. Wells, engineer of construction of the Southern Ry., has been appointed chief engineer of construction of that road, and the office of engineer of construction has been abolished.

Mr. George C. Koons, formerly supervisor of the Pittsburg division of the Pennsylvania, has been appointed engineer of the Cumberland Valley.

Mr. J. A. Shannahan, formerly supervisor of bridges and buildings for the San Pedro, Los Angeles & Salt Lake, has been appointed division engineer in charge of the new shops, roundhouse and other railroad buildings to be erected at Las Vegas, Nev.

Mr. Julius W. Schaub, a consulting civil engineer, well known among railway men, died suddenly on a train entering Chiçago on March 30. Mr. Shaub was born Sept. 23, 1859, in St. Louis, and graduated at the Washington University, in St. Louis, in 1881. During the next five years he was employed in an engineering capacity by the late C. Shaler Smith, C. E. From 1887 to 1892 he was chief engineer of the Detroit Bridge & Iron Works, after which, during 1893 and 1894, he was chief engineer and manager of the Pottsville Iron & Steel Co. During the three years 1895-97, inclusive, he was chief engineer of the Hamilton Bridge Works, and from 1898 to date consulting engineer, with office in the Monadnock building, Chicago. Mr. Schaub was of a quiet, unassuming disposition and of studious habits. He was a prominent member of the Western Society of Engineers, and contributed much to its literature in the way of papers and discussions. He was also a member of the American Railway Engineering and Maintenance of Way Association. He had of late given a good deal of study to the subject of track construction for railways in

tunnels, particularly of the tubular design, such as is found under the Hudson river entering New York, at Port Huron, and at other places.

Mr. Geo. W. Robb has been appointed assistant master mechanic of the Grand Trunk Pacific, with headquarters at Rivers, Man.

Mr. C. H. Seabrook, general master mechanic of the Trinity & Brazos Valley, has been appointed superintendent of motive power and equipment. The office of general master mechanic has been abolished.

Mr. R. N. Millice, master mechanic of the Mexican Central at Aguascalientes, Aguas, Mexico, has resigned and the office of master mechanic at that place has been abolished.

Mr. L. H. Raymond, master mechanic of the New York Central at High Bridge, N. Y., has resigned.

Mr. A. J. Edmonds, general car and locomotive foreman for Sioux City and Dakota divisions of the Chicago, Milwaukee & St. Paul, has been transferred to Madison, Wis.

Mr. W. I. Bell has been appointed an assistant supervisor of signals of the Eastern Pennsylvania division of the Pennsylvania, succeeding Mr. George E. McFarland, promoted.

Mr. H. R. Klepinger has been appointed the chief engineer of the La Fayette Railroad, with office at Dayton, Ohio. Mr. W. T. Sherman has been appointed the assistant chief engineer.

Mr. G. E. Johnson has been appointed the master mechanic of the Wymore division of the Chicago, Burlington & Quincy, with office at Wymore, Neb., succeeding Mr. A. B. Pirie, assigned to other duties.

Mr. W. B. Embury has been appointed the master mechanic of the Oklahoma & Pan Handle divisions of the Chicago, Rock Island & Pacific, with office at Chickasha, Okla, succeeding Mr. W. J. Monroe, resigned.

Mr. G. A. McCarthy, chief engineer of the Temiskaming & Northern Ontario, has resigned and is to become connected with the firm of Smith, Kerry & Chase, Consulting Engineers, Toronto, Ont.

Mr. S. E. Kildoyle, master mechanic of the Vera Cruz & Isthmus, has resigned, and his position has been abolished. Mr. J. A. Baker, general foreman, has been appointed the foreman of shops and locomotive repairs, with office at Tierra Blanca, V. C., Mex., and reports to the acting superintendent.

Mr. A. S. Greig, assistant to the chairman of the executive committee of the Chicago, Rock Island & Pacific, St. Louis & San Francisco, Chicago & Eastern Illinois and the Evansville & Terre Haute, and Mr. Edward S. Moore, second assistant to the president of the Rock Island Lines, will hereafter in addition to their present duties, act as a committee on standardization of all these lines, with office at Chicago. Mr. Greig will be chairman of the committee.

Mr. W. H. Foster, master mechanic of the New York Central & Hudson River, in charge of the Harlem division, with office at North White Plains, N. Y., has been transferred as master mechanic to High Bridge and put in charge of the Hudson and the New York & Putnam divisions, succeeding Mr. L. H. Raymond, resigned. Mr. H. B. Whipple succeeds Mr. Foster, with office at North White Plains. Mr. W. A. Deems has been appointed a master mechanic, with office at Tupper Lake, N. Y.

The Maintenance of Way Department

Gauging Track

Editor, RAILWAY ENGINEERING:

We use the Huntingdon gauge, with forked end next to gauge side of track. I find this method best, as the spiker can always see if the gauge is straight across the track and saves the trouble in feeling to find if both prongs are up to the line rail.

We use tie plates on all curves, the plates having a surface of five and one-quarter inches. The center of spike holes in tie plates are one inch from edge of plate. The plates are paired so that in all ties the outside spikes are driven on the north side, and south on inside. This rule is strictly enforced on tangents. Also, anchoring the track systematically, and might be applied similarly to an east and west bound road.

On tangents where no plates are used, spikes are set about two and one-half inches from edge of tie, with an eight-inch surface, which leaves about three inches between the spike-head in and outside of rail.

Frequency of gauging, which becomes necessary, may be caused by steel running, and in most cases in opposite directions, causing some ties to slew at an angle across track, forcing the outside spike outward. Also track getting out of surface invariably makes it necessary to re-gauge. The first essential is to surface the track, straighten ties, pull out the necessary spikes and fill in spike holes with machine made tie plugs. If ties are sound spikes should be re-driven as near as practicable in place where tie has been plugged. This prevents unnecessary cutting of the tie. If tie is not in good condition, trackmen use their own judgment and drive spikes in soundest part of the tie next to rail.

Care should be taken in setting spikes straight and track should be spiked, so as the rails will make a neat fit with the gauge, not tight, but as we might call a "drop gauge." Curves the same as tangents, and on all curves up to six degrees.

I will also remark that on curves where tie plates are not furnished, the inside or low rail where the traffic is heavy wears the tie most on the outside of rail, causing the rail to lean outward. In such cases it is

very necessary to pull the spikes and adz the ties to get the rail back in surface.

The necessary tools for re-gauging track are claw bars, pinch bars, gauge, adze and spike mauls, according to the number of men employed in the work.

Yours truly,

Missouri. ROADMASTER.

Laying New Rails

Editor, RAILWAY ENGINEERING:

In placing new rails in track I place my new rails in track one rail at a time. I lift the inside spike of my line rail, throw out thirty rail lengths at a time, pick up my new rail and lay it in track and then joint and bolt it up in place. In laying my gauge rail, I pull the outside spike and lay it similar to the line rail, laying it one rail at a time and then jointing and bolting up after in place.

Expansion—In zero weather I allow ¼-in. expansion; 25 degrees to 50 degrees above zero, I allow from ⅛ to 3/16 ins., and for 75 degrees and over, I allow no expansion, laying my rails tight. I never use any split points in making connections. I usually keep short pieces and compromise joints so that I can close out and make my connections by the means of using a short piece of rail, Respectfully,

Illinois. ROADMASTER.

Track Work

Editor, RAILWAY ENGINEERING:

I will give my views on renewing ties, track work and surfacing. Renewing ties should be done in spring and summer. My method for tamping is to tamp ends and shoulder for 12 ins. inside and blade centers to avoid center bound track. Section foremen should not disturb track in late fall and winter, but give their attention to ditching, cutting off shoulders from end of ties to give very best drainage.

I find white oak ties are the best. They will last on an average of eight years. Just want to add a little more, good drainage and good ties are the backbone and sinews of good track. Foreman should be very particular about putting in joint ties and see that they are properly spaced and slot spiked. This applies to where you have nothing but dirt ballast.

Yours truly,

Texas. ROADMASTER.

Cleaning Weeds from Ballast

Editor, Railway Engineering:

In my opinion there is more damage done to ballast by cutting weeds in wet weather than there is good done. I have found that weeds and grass should be cut from the ballast during dry, hot weather, and should be cut once in each month, commencing in this part of the country about the 15th of June. By cutting them often it makes the work much easier than to allow them to get such a growth. Four good men will clean all weeds from five miles of track in two days where they are cut once a month, but if they are allowed to grow two months it will take four men six days to clean five miles.

I have found that mowing right of way in July and August is a waste of time and money and nothing is accomplished. I have my men pull all thistles, parsnips and wild clover, better known by section men as sweet clover, during the early part of summer after heavy rains, then we do no mowing of right of way except to mow one swath along base of ballast, known as mowing grassline. Then I burn my right of way as soon as the grass and weeds get dry enough, about the first of October, and by so doing I find that we are getting much better set of blue grass and less weeds every year. I also find that we do not have so much damage done by fire where the right of way is not mowed during the summer months. All brush on right of way we have cut during December, January and February, which I find in most cases kills the roots.

Yours very truly,

Indiana. ROADMASTER.

Relaying Rails

Editor, RAILWAY ENGINEERING:

We have since 1903 been substituting 100-lb. rails for 80-lb. rails. The new rail, being ¾ of an in. higher and ¾ of an in. wider at the base than the old rail, prevents to some extent from stringing it up on the ends of the ties. In addition to the new rail being ¾ of an in. higher than the old rail, the old rail is in many cases cut in to some of the ties to a considerable extent, which would raise the new rails if laid on the ends of the ties, considerably higher than the rail in track.

When a long string of rail is bolted together and is laying loose on the ends of the ties, if not reasonably well spiked, it will in hot weather kink, and in so doing may get dangerously close to the track. However, if the section of the rails which I am laying is the same, or nearly so, as those taken out, I lay the new rail in springs, as I will try to explain later on.

When taking out 80-lb. rail and laying new 100-lb. rail, I do so by throwing out the old rail and before removing the bolts. As our track ties are largely cedar, they are equipped with tie plates. As the old tie plates have to be removed, that is done as well as the necessary adzing and the plates applied. The new rail is then laid in, one rail at a time, full bolted and spiked. I always keep the work of removing the old rail and the laying in of the new rail, close together and in such a manner as to make connection readily and without delay to traffic. I use a 15-ft. switch point, fastened with clamps for making connections. The switch points used are the same rail section as the old rail taken out and connected to the new rail by means of a step splice. In advance of rail laying, every alternate spike is withdrawn from the inside of

the old rail and bolts are later removed from the old rail as time will permit for shipment.

No rails, old or new, are allowed to lay loose between cattle guards at highways or on private crossings or in the immediate vicinity of station.

When laying new steel and when the rail taken out is of the same section or nearly so, I string the new rail on the end of the ties, where it is full bolted in that position. The number of rails placed in position will largely depend on whether working in tangent or curves, also the time of important trains to be considered. Every alternate spike is withdrawn from the old rail and necessary adzing done before breaking the track. On straight lines it is the custom to have a string of new rails in position for a half of a mile in length or more, this however, is largely controlled by the condition of the track, as joints will not hold proper expansion if laid in too long strings around curves. This feature is one which the foreman should carefully watch. Care should be taken to see that adzing is properly done to give a uniform wheel bearing on the head of rails. Joints should be full bolted and bolts made securely tight to hold proper and uniform expansion before expansion shims are removed from the joints. I use steel expansion shims made in inverted L shape so that they can not, if joint becomes loose, fall in between the rail ends and are readily removed. Sizes used are as follows:

120° to 97°.....1/16″
76° to 53°.....3/16″
30° to 7°.....5/16″
97° to 76°.....⅛″
53° to 30°.....¼″

Yours truly,

Michigan. ROADMASTER.

Hints on Drainage

Editor, RAILWAY ENGINEERING:

Regarding ditching cuts, it all depends on the width of them as to the best kind of ditches to establish.

Where wide enough to establish a berm from bottom of ends of ties to distance sufficient to extend, say six inches outside edge of ballast giving slope of same one-half inch to a foot, then a box shape ditch should be established of sufficient width to take care of water that falls and drains from track, also slopes of cuts, the ditches to be sodded as well as slopes of cuts to prevent washing. This is my idea of what constitutes a good ditch.

On this portion of the line we try to standardize everything, but owing to the various conditions existing have to treat them as they exist.

We have cuts that fill ditches and cover track after every heavy freshet and especially when frost goes out of the ground. Nature and soil is such that even though slope is three to one foot, yet earth slides into ditches the amount that frost usually penetrates or enters ground so that there is little show for establishing permanent ditches where such conditions exist.

Sowing various kinds of grass seed on the slopes of cuts referred to has been tried, but without avail. I am very much in favor of diverting all water except what falls from track ditches, which can, in most instances, be done by establishing surface or cross ditches.

The avoiding of carrying water in track ditches only until it can be disposed of or diverted cannot be too strongly advocated.

I can call to mind many stretches of track on different lines where track ditches are established on side hills where water is carried long distances, thereby playing havoc with roadbed where it could be carried off direct if proper provisions were made.

The trouble is that in many instances inspections and recommendations are made by parties who only see conditions at time of the year when inspections are made, hence cannot be expected to know requirements.

I have often thought what a benefit could be derived by all concerned to have someone make a specialty of drainage, thereby having an opportunity to view conditions frequently enough to become familiar with requirements.

As to the best time for doing ditching relative to sliding cuts. They, of course, have to, or should be cleaned out every time they become filled sufficiently to interfere or block trains. Usually before fall rains, or when final time of cutting of weeds, etc., is the customary time and in my opinion the best, as it then takes off fall rain as well as to prepare for same the following spring.

BALLAST AND SLOPE OF DITCHES.

We use mostly concrete gravel ballast on this line, there being no other kind accesible. The former has to be provided with sufficient slope from center of track to take care of water which falls and convey it away quickly. The method employed here is to form gradual slope to outer edge of ballast. With material that water passes through, such as washed gravel, crushed rock, burnt ballast, cinders, etc., such can be shouldered up within one or two inches of tops of ties and is, of course, better, there being more support in way of keeping in line, preventing it from becoming center bound, etc.

But again, local conditions existing have to be considered. With us, practical roadmasters, it is a much less difficult task to execute and do the work than tell or write about it. The local conditions and judgment displayed combined with close observation is in my opinion of more value and usually brings about the best results.

Where it is necessary to cut a good deal of grass in track by hand it is more difficult to maintain shoulder than otherwise. Traffic here is exceedingly heavy in summer season especially, and with little or no weeds to cut where loads in our ore traffic pass

over, the greatest contention is to keep track from settling into ballast to the extent of becoming defective for lack of drainage and expensive relative tie renewals, surface, line, etc.

It is my understanding that width of berms are governed according to height of fills, nature of ground, etc., but in my opinion edge of berm should never be less than from eight to ten feet from toe or edge of slope. Many railroads are paying dearly for lack of attention given this feature at time of construction.

Vitrified tile has been found best in my experience for draining ditches, roadbed, etc., and to be placed below frost line. The ditch on top of tile is to be filled with cinders, and tile to be laid with sufficient fall and uniformity so as not to permit water to lodge and to flow fast as circumstances or conditions warrant, beginning and ending of tile to be protected with hood or something to prevent freezing.

Drain tile has been found beneficial not only for draining roadbed, but prevents track from heaving during winter months, which would justify use of tile alone.

The contention of heaved track can only be appreciated where it exists.. Its effect disturbs two very essential features of good track very materially—that of line and surface.

I have wondered if the manufacturers and advocates of steel ties have considered the matter of shims and how and what is termed spike lining track, after it heaves out of line, is going to be done.

It seems to me it will have to be given consideration or the matter of overcoming heaving will have to be solved, the latter being an expensive proposition in this country. Yours truly,

Wisconsin. ROADMASTER.

Relaying Rails

Editor, RAILWAY ENGINEERING:

We place the rails from cars alongside of track exactly opposite the place they are to be laid, breaking joints.

LAYING NEW RAILS IN TRACK.

In the first place we pull two inside spikes and leave one on tangents. On curves, every other spike. After trains have passed we pull all the inside spikes and throw the old rail out. Then we bring the new rail in one rail at a time with the rail tongs, and follow up with the new rail, the old rail being thrown out ahead. Gang of men behind bolt up the new rail and spike it. Keeping in the clear of all regular passenger trains we continue to lay until a freight train shows up and then we make a closure by cutting the old rail. In five minutes we are ready to let trains over. In this way each new rail has the right expansion. We do not use the short point rails. We lay one mile of track per day and have laid three miles of track per day where not too many trains. Yours truly,

Indiana. ROADMASTER.

Relaying Rails

Editor, RAILWAY ENGINEERING:

My method of distributing the new rail for relaying, where rail is loaded in stock or end door box cars, is to use toggle chain or rope fastening with a quick release hook in the end holes of two rails, with a grab bar to catch the tie. Starting the engine will quickly pull the rails from the car.

By watching signals very closely the rail can be distributed accurately in this manner. The best record I have been able to make, unloading by this method, is fifteen car loads per day, where traffic is pretty heavy and long distance between stations. Of course I unload a less number than this in days than I do this number.

The method of removing the old rail is done by pulling three lines of spikes. This was made necessary from the fact that we are invariably laying a considerable heavier rail than what we are removing, making it necessary to adz the old tie for a wider base rail. I find that the adzing can be done more satisfactorily after the old rail has been thrown out, keeping sufficient number of adzers ahead for the setting of the new rail in, which I find is done more satisfactorily by placing one rail at a time instead of coupling up a long string of them togehter. The expansion can be more evenly maintained. Closing up for trains, the point at hand can be applied and connection made in a very few moments, ten to fifteen.

With 75 men I have laid to the extent of 17,000 feet in 10 hours. I think it best to pull spike and full bolt the new rail the same day it is placed. I also think it is best to follow up closely with a gang putting in the joint ties and in fact all the ties that should be put in, because it is injurious to new rail to allow them to run on a lot of bad rotten ties very long.

Yours truly,

Oklahoma. ROADMASTER.

Relaying Rails

Editor, Railway Engineering:

In laying steel, we always lay one rail at a time. Our traffic is very heavy, and we think this a better way than to lay it in strings.

In the first place, the steel and fastenings are all unloaded and distributed along the track ready for use. New steel is always pulled off the cars at the end by means of ropes, which has a rail clamp on one end and a hook in the other end to fit the bolt hole in rail. The hook is inserted in the bolt hole, and the clamp is dropped on the top of the rail, the train moves slowly, the rails then fall on a push car provided with permanent side slides from the center to each side of the car, from which the rails slide off sidewise to the ground. With such an arrangement, four men in the car and six men on the ground will unload about 700 rails per day, without injuring the rails, and get out of the way of a good many trains.

When laying broken joint track, the rails of different lengths are unloaded together, as much as possible, in order to avoid delays in changing from one length of rail to another. We lay one side by pulling the outside spikes only, and we use tie plugs for all spike holes and spike this side up against the inside spikes, except where the track is kinked; in that case, we have a man stationed to watch the new rail being spiked, in order that the spikers will not kink it. On the opposite or gauge side, we pull both inside and outside spikes, and put the track to perfect gauge.

In laying around curves, care must be taken to adze all ties so that the new rail will set to a perfect plane with the track, a trifle canting of the rail inward, even on straight track as well as on curves, is recommended on a trunk line.

Before laying the rail, the angle bars are applied to the rails with one bolt partly turned up, so the angle bar will not fall off. The angle bars are applied to the head end of the rail in the direction in which the laying is being done. In this way, four men will keep up the bolting behind the laying, and you are always ready for trains, by taking a few turns on this one bolt, if you have not the time to put in more.

On double track, as a rule, we lay steel with the current; in so doing we find we secure better results with expansion, as the new rail naturally works ahead and closes up the expansion, where trains run all in one direction.

On double track we use the L. & S. No. 9 anti-rail creepers, applying two to each rail. As fast as the rail is laid, these two anti-rail creepers are put on in the long quarter of the rail. When the tie spacing is done on the new rail, we apply one on each joint tie opposite the joints; thus, with a 2-joint tie, we have four anti-rail creepers per rail, and with the 40-inch bars with three ties, we use three anti-rail creepers opposite the joints, making five to a rail, or ten to a rail length of track. For the center tie on a 40-inch bar, we have a joint tie holder, which fastens to the two center bolts, and spikes to the tie, and holds the tie in place when the track creeps. With ten anti-rail creepers to a rail length of track, we find but very little trouble with track creeping or ties slueing.

Ordinarily, we work between 75 and 90 men, when laying steel, and average about one-half mile of track per day, with an average of 30 to 40 trains to let by the gang. This also includes the unbolting and picking up of rail. When laying rail, we always have a work train to take the men back and forth to work, and between times, this work train with about ten men loads up the rail and scrap with a rail leader.

We use a switch point for making connections for trains, and always face the point in the direction from which the train is approaching; this is done to avoid possible danger from a high stock rail, which would be likely to cause a derailment, several of which have occurred on some roads on trailing points used when laying steel. Yours truly,

Illinois. ROADMASTER.

Drainage

Editor, RAILWAY ENGINEERING:

The subject of drainage is certainly an important one with me—not so much in the way of ditching cuts, however, as this line for miles runs just behind the Levee, and on light embankments. We follow low swampy country, impossible to get drainage, and in many places so close to the river that in time of high water we are caused considerable trouble on account of seip water. The great problem with us is to keep the embankments dry; we have very little ballast and fills gumbo.

I have followed with considerable success a system of cross ditches on the fills—by cutting ditches through the embankments from eight inches to two feet below bottom of tie according to height of embankment and filling the ditch with coarse cinders; these ditches to be cut about 15 ft. apart. I have obtained more satisfactory results from this than from any one thing I have tried. Yours truly,

Arkansas. ROADMASTER.

Renewing Ties

Editor, RAILWAY ENGINEERING:

I will take up main track ties only. When renewing such ties, the supervisor should have his foremen go over their section in the fall after the fall work is done and before snow to inspect the ties and send an estimate showing as near as they can the number of ties required for renewals for the following year.

Foremen should show the number of ties required for each mile, giving the number of each mile post. Supervisor should check this estimate to justify him in ordering next year's supply. He should order what he thinks he will need with recommendation that he may want to increase the amount a few thousand.

The ties should be delivered as soon as possible—November or December preferred. As the ties are being received they should be unloaded, a few in a place, and piled in small piles on high ground outside of the sod line to season, and foremen should put about the required number to the mile on that mile.

In March or as nearly as the weather will permit the supervisor should go over his division, taking each foreman over his section to inspect the ties to be taken out. A good way to do this is to have a can of paint and a brush, the foreman to walk on one side of the track with the paint and the supervisor on the other and examine the ties carefully, the foreman spotting each tie that they decide should come out. The supervisor should take a record of each tie that should come out on each mile.

Ties should not be cut, notched or pieces broken off to determine whether the tie is rotten enough to be taken out, nor this should not be done when taking out ties, as it does no good. It, however, causes more work, makes bad looking track and destroys ties that would not have to be taken out but for this mutilation.

After a supervisor knows his foremen, it may not be necessary for him to go over his entire division to spot ties. He can have his foremen do this, but he should check them up later, as some foremen may want to take out ties that would last a year, other foremen may not want to take out enough ties. The supervisor should adjust this and keep a record of tie renewals which will enable him to keep a check on ties. When ties are inspected and spotted, supervisor should check them up and notify each foreman how many ties he is allowed each mile; if necessary supervisor should increase his order for ties.

Foremen should be notified when to distribute their ties, this depends on the weather, but the middle of March is not too early in our district. The best ties should be left at joints, ends of bridges and crossings. Men should be careful when distributing not to put ties where they will interfere with trainmen and others doing their work. They should not be left where they will be in water or washed away in time of flood, or on fills where they are likely to be rolled down the embankment. Before ties are distributed there should be a general notice put out to trainmen and others to look out for ties distributed along track.

Men should begin putting in ties as early as possible, any time after the middle of March or when their work and weather will permit. Foremen should go over their sections and remove all broken or very bad ties first. Then if they have any very rough track, this should be gone over, put up, and tied, then begin where gravel and drainage are the best. I am speaking of gravel ballast. It depends some on the number and kind of men as to how ties are put in, as there are several ways of doing this work, like other kinds of work, which are all good. The important thing to see is that the track is kept safe, and that the ties are put in right. If on curves it is a good plan to work under a green or slow flag. In tamping new ties put in, it is necessary to spring them or tamp them stiff. It depends on the weather and kind of gravel as to how much new ties should be raised, but a good foreman will soon be able to handle this so a few trains will settle the new ties, so that they will be about as solid as the old ones. It is a good plan for early spring time not to spike the new ties as they are put in, but surface them up and let a few trains over to see how they settle. A new tie put in right should be solid enough to be spiked after several trains have gone over it without having to hold it up with a bar.

We never leave more than two ties without spikes on straight track and one on curves. A train should not be let over track with a tie out or down from the rail if it can be avoided, especially a joint tie. Old ties should be picked up, piled and burned once a week, or oftener unless they are being held for shipment or inspection.

We do not neglect our other work when putting in ties, but carry it along and we do not neglect the new ties put in, especially if it sets in wet, but we do like to get our new ties in early.

Yours truly,

Indiana. Roadmaster.

Spiking and Gauging Track

Editor, RAILWAY ENGINEERING:

In gauging, our method is to start at one end of the sections about the 1st of December and work toward the other end, gauging the track which is to be given a general overhauling the following season and, starting at the end where the tie renewals will be started first.

The idea on double track is to work each track every other year from end to end, and on single track work half the section with heavy renewals every year, and cover the entire section every two years. By gauging during the winter the track to be worked the following season, when tie renewals are commenced in the spring, the track is to gauge.

RULES FOR SPIKING.

Spikes must not be driven less than two inches from the edge of the ties. The outside spikes must be opposite each other and on the north or west edge of the tie, and the inside spikes must be opposite each other and on the south or east edge of the tie. The ends of the ties are set to line on the outside of the track on double track and on the west or south side of the track on single track. Where the spikes will hold in the ties they are redriven in the old spike hole after the holes are plugged with tie plugs.

In gauging, the line rail is first brought to line by setting the rail up to the inside spike. In order to do this the bur is cut off the ties on the inside of the rail to let the rail in to the inside spike. Every other spike on the outside of the rail is removed, holes plugged with tieplugs, and the spikes redriven. The rail is lined with the eye, being crowded in or out with a claw bar to line and then spiked. Spikes on the inside preventing the rail from being put to line are bent back and driven down to the rail. Spikes away from the base of rail are pulled out, the holes plugged and spikes redriven to the base of rail. After the spikes in every other tie on the outside of the rail for about a rail length have been redriven, the remaining spikes on the outside are removed and reset to the base of the rail. The same operation is repeated for the succeeding rails. The work is carried forward along the line rail to a point where it is estimated by working the balance of the day on the inside rail both rails will be matched up at night. Corroded track spikes and spikes, cut ⅛ of an inch or more in the neck are scrapped. Spikes removed fit for use are preferably driven on the inside of rail, new spike used on the outside of rail. At slot holes in the angle bars inside and outside of the rail, the spikes are all removed and new spike substituted. New spike in the slot holes have square edges and tend to better hold the rail from running. By spiking the

line rail in its original position on the ties keeps the ends of ties to line. The inside rail is now brought to exact gauge (4 ft. 8½ in.) with respect to the line rail, starting the work opposite the point left off on the line rail and working back to the starting point. The method of doing this is to cut the bur off the ties on the inside of the rail. Pull the spike on the outside of the rail in every other tie for about a rail length ahead of the work and keep the spikes pulled on the inside of the rail for five or six ties ahead of the work. By this method of working the track is kept safe for trains at all times. The inside rail is spiked inside and outside to gauge on every other tie. In this operation the track gauge is used to insure correct gauge. When about a rail length of the track is spiked to gauge on every other tie, the remaining spikes are removed from the ties in that rail length and holes plugged and the ties are spiked inside and out. In this operation, as every other tie has already been spiked to gauge, the track gauge is not used. This operation is repeated for the succeeding rails until the inside rail is gauge up to the starting point for the day. The bur is cut off the ties on the inside of the track to prevent the base of rail from riding the bur, tilting out the rail, causing the wheels to run on the inner edge and not covering the full head of the rail. This is objectionable as it tends to decrease the life of the rail and prevents proper bearing of the base of rail on the ties and makes it more difficult to keep the rail to gauge. The spikes we are receiving will only last under our traffic from 3 to 4 years.

One rule is to spike all track to gauge (4 ft. 8½ ins.) for curves up to 6 degrees—from 6 degrees to 10 degrees, widen the gauge ¼ inch, from 10 degrees to 14 degrees widen the gauge ½ inch, from 14 degrees to 18 degrees widen the gauge ¾ inch, and all curves over 18 degrees widen gauge 1 inch. Under favorable conditions, a foreman and four men will gauge 300 to 400 linear feet of track per day. Tools used—one adze, one track gauge, one claw bar and two spiking hammers, and will use about one keg of track spike and a keg of tie plugs.

During the winter months our section force on double track consists of foreman and four men, and on single track, foreman and three men. In gauging, the foreman superintends the work, looks after the safety of the men, and the safety of the track for trains. One man is assigned by him to do the adzing and cleaning up; one man to handle the claw bar, remove the spike, and where necessary hold the rail in position for spiking; and two men to do the spiking, forward man, using the track gauge, spikes the ties inside and outside of the rail on every other tie, the other man follows up spiking the remaining ties inside and outside of the rail.

On single track sections the same operations are followed, except the foreman in addition to his other duties handles the adze.

The work cannot be carried on continuously day in and day out on account of other work. The plan is, as far as possible, to gauge one track on double track from end to end, and all the track on single track sections, during the winter months.

Yours truly,

New York. Roadmaster.

Relaying Steel

Editor, RAILWAY ENGINEERING:

I believe more questions arise as to the work in detail in relaying steel than in any work pertaining to the track department.

In ballasting the principal question aside from the depth of ballast to be under the ties, is the dressing of the track after it is ballasted; and, as in other track work, such as ditching, dump widening, etc., it is simply a question of distributing the forces so as to do it as cheaply as possible; and it is practically done by the one method, that applies to the kind of work in question. But this is not the case with regard to relaying steel, or in other words there is a standard way generally understood by roadmasters and track foremen of doing almost all track work, except relaying steel, which is open to much discussion.

UNLOADING STEEL.

Although some advocate the unloading of steel so that it will be placed on the ground lightly, either by means of unloading it first from the flat or box car onto a push or iron car and thence to the ground, or by running it out on arms with dollies on them which extend from the end of the car to about 18 inches above the ground, I do not consider the additional expense of unloading the steel in this manner warranted by any saving to the rails. I have found that rails can be bodily thrown off the car so that both ends hit the ground at practically the same time without damaging the steel, except in exceptional cases where the ground is uneven. In fifteen miles of steel I distributed for re-laying last fall we had no rails damaged in unloading so as to make them unfit for main line service, and certainly the saving in time and wages by unloading the steel as I advocate against handling it so that it will be placed lightly on the ground, will pay for a great many more rails than could possibly be broken by throwing them off bodily, and using some care while doing it.

Regardless of the number of cars of steel you may have in your train, time will be saved by unloading from but one car at a time. With a gang of eight men with tongs on each side of the track to heel the rails as soon as they are thrown off, and with the careful spotting of the car at each move, the steel can be distributed so as to have no space or laps at the ends of the rails and avoid carrying a succession of rails backwards or forwards to close up a gap or to straighten out an overlapping.

PLACING STEEL.

After your steel, angle bars, bolts and spikes are

distributed, comes the question as to the best method of putting the new steel in. I am not at all in favor of putting together any length of rails first, to be put in the track in one piece. This makes it hard to keep the proper expansion on account of the expansion shims coming out, or if not iron, being driven together when put in place, besides its being awkward and not as fast as if the rails are put in the track and bolted one at a time. The length of track to open up and lay at a time depends entirely on the amount of traffic. Where you have many trains to contend with you can lay but a short space on one side at a time. In closing up it is perfectly safe, easier and more economical to use a switch point of the size of steel that it being taken out. The point should be securely bolted, spiked and clamped and the rail it lays against well braced on the outside the same as a stock rail in a switch.

The principal feature to obtain the best results in relaying steel is to get the correct amount of space to be allowed at the joints so as to provide for the expansion in hot weather and avoid the kinking and buckling of rails which will surely follow if sufficient room is not left for this expansion; and on the other hand the re-action of the rails in cold weather is contraction, and therefore, to avoid broken bolts and battered joints, the results of too great a space at the joints, one must be exceedingly careful to get the distance between such as to suit the reverse actions of the rail under different temperatures. Of course the temperature at the time the rail is being laid governs entirely the size of expansion shim to be used. All roads have tables showing what space should be left at joints at different temperatures. If the tables were rigidly followed there would be no doubt as to the results, but it is the unimportance that so many attach to this most important feature that reflects generally upon the entire relaying.

In my opinion the best expansion shim is made from wood or a wire nail, the size to depend on amount of expansion wanted. The only objection to the former as a shim is the liability of crushing it when heeling the rail. The wire nail is preferable in every way except its cost as compared to the wood.

Another important feature and one which will subsequently save time and expense is to put the track that is to be relayed in the best possible line before the relaying is commenced, so that the side being laid can be truly spiked to exact gauge to old rail left in, and the same to be done to the last new rail to go in, thus avoiding any kinks or swings in new steel, which are both damaging to the rails and hard to take out after steel is laid.

An economical feature in relaying steel and one I believe not generally watched very closely is the percentage of new spikes to be used. I use 20 per cent new spikes in the following manner: two at the joint, two at each quarter and two at the center. This gives the lead and gauge spikers (the spikers that must be fast) new spikes to work with, and use the old spikes to full spike with.

Where the same size bolt is used in the new steel as in that taken up, 40 per cent of the old bolts can economically be used. It pays to break the bolts with a hammer only where you break the old steel to start the new, as the old steel from there on to where you close up for the next train can be thrown out in one piece and later the bolts taken off with wrenches when not badly rusted and re-used. Steel should be full bolted as laid and bolts re-tightened a second and third time.

I do not believe any important track should be laid without tie plates. Tie plates are a big saving to ties and labor and give greater security and safety to your track. If tie plates are used it is very important to adze the tie so as to give the plates an even bearing. The rails on both sides should be laid level on the ties.

I have not touched on several minor features that play more or less of an important part in the relaying of steel, principally because they can be done in many different ways with equally good results and in the same length of time.

To get the most out of every man and the best general results a steel gang should be composed of about 90 men and organized as follows:

1 Foreman.
1 Assistant foreman.
32 Claw bar men.
3 Men throwing out old steel.
6 Adze men.
2 Men putting on tie plates.
12 Men on tongs placing new rail.
4 Lead bolters.
4 Gauge spikers.
8 Tightening bolts second time.
12 Back spikers.
2 Flagmen.
2 Men on push car distributing bolts, spikes, tools, and carrying switch point.
1 Water boy.

Yours truly,

Montana. Roadmaster.

A folder completely and attractively illustrating their new desk stand has been recently issued by the Kellogg Switchboard and Supply Company, Chicago, Ill., and will be sent to those interested on request. Telephone men now in the market for desk stands will find this brief bulletin (No. 46) interesting. The front and rear views of the stand give an excellent idea of its appearance. Other illustrations show base with plate removed, and a cross section view of the transmitter and lug. Evidence of the popularity of the new Kellogg desk stand is given in an illustration of a recent shipment on the way to the packing room.

Wanted position as roadmaster by man of 10 years' experience. He can furnish personal endorsements. Address Box 24, Railway Engineering, Security building, Chicago.

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The Maintenance of Way Convention

The tenth annual convention of the American Railway Engineering and Maintenance of Way Association, held at the Auditorium Hotel, Chicago, was called to order on March 16 by President Wm. McNab. The attendance at this convention was very large in view of the important recommendations that were made by the committees. The membership in this association increased during the year from 680 to 784 members.

The officers elected for the ensuing year were as follows: President, Wm. McNab, Grand Trunk Railway; second vice-president, W. C. Cushing, Pennsylvania Lines West of Pittsburgh; Secretary, E. H. Fritch, re-elected; treasurer, W. S. Dawley, Missouri & North Arkansas R. R.; and directors (for three years), A. H. Rudd, Pennsylvania R. R., and A. W. Thompson, Baltimore & Ohio R. R.

On the following pages of this issue a brief review of the work of this convention is given, containing mainly the conclusions which were presented by the committee, as amended and adopted by the association. The Manual of Recommended Practice, issued by this association, will be revised and enlarged through the recommendations adopted at the convention.

In regard to the committee report on Specifications for Mechanical Interlocking, same were referred back to the committee because the report did not contain a specification for wrought iron pipe. A report on a standard interlocking agreement for signal work was also presented, but all the conclusions were not adopted. The matter will be brought up again at the next convention.

Regarding the injury to signal equipment, bridges and track due to brine drippings, all the data contained in this report is referred to the American Railway Association, with a request to take some action. No definite recommendation was made as to the method of disposing of brine, but from the discussion it was generally understood that the brine dripping would not be deposited in the middle of the track for the reason that this would still produce an injurious effect in insulation resistance for signal circuits. The matter of retaining the brine drippings within the car will probably be referred to the Master Car Builders' Association.

The track committee presented tables containing a numerous list of lengths of switches and frogs. Several members of the association objected to the long list, but it was found upon discussion that the different roads could not agree upon three or some small number of standard lengths. Resolutions were adopted which provided for standard width of flangeway for frogs and guard rails.

The resolutions of the committee on ties were adopted but altered in one respect so as not to refer to screw spikes. The reason given for this was that the association should not at the present time commit itself as to the merits of screw spikes . The information received, however, indicated that screw spikes used with tie plates have been successful. Regarding steel and reinforced concrete ties the committee made an extensive investigation presenting certain conclusions which were received by the association as information. The latter question is to be considered at the next convention.

Standard specifications for yellow pine bridge and trestle timber were adopted. The conclusions also of the committee on timber preservation were adopted, and are noted on another page of this issue.

After much discussion new definitions for "Gravel" and "Sand" were adopted, but the recommendations for proportions of gravel and sand in gravel ballast for different classes of road were referred back to the committee.

In regard to the recommendation of the committee on buildings as to the use of reinforced concrete for engine house roofs, a conclusion of the committee was not adopted. While numerous reinforceed concrete engine house roofs have been constructed and were found satisfactory it was not considered best to make this conclusion so specific because under certain conditions the reinforced concrete would not prove economical. The conclusion, as it now stands in the Manual, was thought to cover the situation satisfactorily. This same committee also presented a resolution on smoke

jacks to which there was considerable objection, one objection being to the recommendation of a circular section above the hood. The latter conclusion was not adopted and will be revised for presentation at the next convention.

The committee on impact tests reported through Prof. F. E. Turneaure the progress which had been made during the past year. Resolution was adopted that these impact tests be continued and that the board of directors of the association find means to do same.

The above review considers only the few points that were considered of most importance at this convention. Other information is given in the following pages and takes up briefly each committee's work.

The Maintenance of Way Convention Reports

Roadway

Committee No. 1

The following conclusions of the report on Roadway, as amended at the March, 1909, convention, are given below:

WATERWAYS.

(1) In determining the size of a given waterway, careful consideration should be given to local conditions, including flood height and flow, size and behavior of other openings in the vicinity carrying the same stream, characteristics of the channel and of the watershed area, climatic conditions, extent and character of traffic on the given line of road and probable consequences of interruptions to same, and any other elements likely to affect the safety or economy of the culvert or opening.

(2) (a) The practice of using a formula to assist in fixing the proper size of the waterway in a given case is warranted to the extent that the formula and the values of the terms substituted therein are known to fit local conditions.

(b) Waterway formulas are also useful as a guide in fixing or verifying bridges and culvert areas where only general information as to the local conditions is at hand.

(c) The use of such formulas should not displace careful field observation and the exercise of intelligent judgment on the part of the engineer.

(d) No single waterway formula can be recommended as fitting all conditions of practice.

SLIDES.

(1) Every slide should be considered as a problem by itself.

(2) The cause of the slide should be sought. The removal or prevention of the cause is as important as the restoration of the roadway.

(3) Piles or retaining walls for the prevention and cure of slides are not recommended; but their use is permissible for temporary repairs and in special cases.

(4) Underground water if present should be drained away or intercepted before it reaches the slide.

(5) The surface of the slide and the restored roadway should be graded so water will run off and not lie in pools The surfaces may be compacted or sodded.

(6) The flattening of the slope is the most economical and permanent method of curing a sliding embankment.

(7) The removal of the material is nearly always the most economical and permanent method of curing a slide in excavation.

(8) A relocation of the line is sometimes necessary where the slide takes the proportions of an avalanche.

WASHOUTS.

(1) The ends of trestles and bridges should be protected with riprap or by other efficient means.

(2) Main track should be raised above height of flood waters and carried on strong and stable roadbed, so that it will not be subject to overflow.

(3) The track on an embankment subject to overflow should be ballasted with heavy angular ballast and anchored, and the lower slope of the embankment is sufficient to carry protected with riprap.

(4) On bridges subject to overflow the track should be anchored.

(5) If the velocity of the water carries away the riprap or other protection against scour, the width of the opening should be increased.

(6) If track is washed out temporary repairs should be made by filling in, cribbing or driving piles, to be followed by the permanent restoration of the roadway.

SURFACE AND SUB-SURFACE DRAINAGE AND TILINGS OF WET CUTS.

(1) All the water possible should be kept off the roadbed.

(2) Surface intercepting ditches should be constructed for the protection of cuts.

(3) Intercepting ditches or pipe drains should be provided for the protection of banks built on saturated soils.

(4) Side ditches should be constructed in cuts through all classes of materials.

(5) Pipe drains should be provided for the drainage of wet cuts.

Ballasting

Committee No. 2

The following definitions of gravel and sand for ballast were recommended by the committee as well as ballast for different classes of road. The definition for sand ballast was amended as printed below and adopted, but the recommendations for ballast for different classes of road were referred back to the committee.

Gravel.—Small worn fragments of rock occurring in natural deposits that will pass through a 2½-in. ring and be retained upon a No. 10 screen.

Sand.—Any hard granular comminuted rock material which will pass through a No. 10 screen and be retained upon a No. 50 screen.

Your committee recommends, as a good practice, the following proportions:

For Class A Roads: Ten parts gravel and three parts sand. Where bank gravel contains more than 2 per cent dust or 40 per cent sand it should be screened or washed.

For Class B Roads: Ten parts gravel and six parts sand. Where bank gravel contains more than 3 per cent dust or 60 per cent sand it should be screened or washed.

For Class C Roads: Ten parts gravel and ten parts sand. Any bank gravel which does not contain an excess of 6 per cent dust may be economically used.

Functions of Good Ballast.

(1) To provide a medium for uniform distribution of the pressures and stresses in the rail from the ties to sub-grade.

(2) To insure a firm, smooth and level bearing for the ties.

(3) To quickly and thoroughly drain all water from the ties, reducing to a minimum conditions tending to decay.

(4) To provide a material between the ties to prevent the skewing and forward movement from the creeping tendency transmitted from the rail.

(5) To secure a material free from dust and dirt, thus preventing growth of grass and weeds.

(6) To provide a medium on which frequent adjustment of line and surface can be made, with as little disturbance to general conditions as possible, and which can be readily worked in renewal of ties.

(7) To insure freedom from the effects of the elements, such as frost-heaving, disintegration, etc.

(8) To provide a foundation which will give a certain degree of elasticity to the track, and insure even riding.

A good ballast should not become muddy when wet, and should be free from dust when dry. Either one of these conditions insures the other, and a dustless ballast is particularly desirable when there is a heavy passanger traffic, as the comfort of the passenger is seriously interfered with by clouds of dust filling the cars. Dust also has a certain wearing effect on all moving surfaces of the engine and cars, such as the journals, crosshead guides, etc.

Ties

Committee No. 3

The conclusions of committee No. 3 were adopted as given below. The forms referred to in conclusion No. 1 are to be used for a compilation of statistics and are to be distributed annually among the railroads.

CONCLUSIONS.

(1) That Forms 1, 1-A, 1-B, 1-C and 1-D be withdrawn from the Manual and Forms M. W. 301, M. W. 302, M. W. 303, M. W. 304 and M. W. 305 be substituted.

(2) That the conclusions in reference to timber supply be approved.

(3) That the conclusions of the committee in reference to metal and concrete ties be received as information.

Timber Supply.

The sub-committee on forest supplies has during the past year devoted its attention principally to investigating policies which could be followed at this time to encourage the more economical uses of the timber supplies still on hand. This problem is such a large one that it has not been thought desirable to make more than a progress report.

CONCLUSIONS.

(1) Use chemically treated ties wherever practicable.

(2) Protect all ties against mechanical wear.

(3) Enforce the tie specifications rigidly with particular reference to the rigid exclusion of small ties.

(4) Co-operation among the roads in any given territory, looking toward the adoption of standard tie specifications, with particular reference to making it impossible for contractors to furnish ties cut from small trees, which would naturally form sources for future tie supplies.

(5) Adopt measures for reducing forest fires.

(6) Encourage the owners to re-forest their lands either by re-planting or natural reproduction.

(7) Use the proper means to aid and assist in the investigation of tax laws as far as they pertain to forest lands with a view to having legislation enacted which would make it possible to hold lands with growing timber for the purpose of future tie production.

Metal and Composite Ties.

The committee investigated a large number of metal and composite ties and drew their conclusions therefrom.

CONCLUSIONS.

(1) Experiments with the steel tie should be extended, and results carefully watched and reported to the association.

(2) The committee concludes that no form of reinforced concrete tie has been made which is suitable for heavy and high-speed traffic, but believes a properly reinforced concrete tie, with proper fastenings, may be found economical in places where speed is slow, and where conditions are especially adverse to life of wood or metal.

Rail

Committee No. 4

As to reports required by the rail committee, the following recommendations were made:

(1) That Form M. W. 2003-A, heretofore submitted (see Bulletin 102), be approved as a standard form of the American Railway Engineering and Maintenance of Way Association for receiving reports of the chemical analysis and physical tests of individual rails.

(2) That a complete report of the study of an individual rail should consist of:

(a) Copy of the track foreman's report on Form M. W. 2002-A, after being checked by an engineer.

(b) Results of chemical analysis and physical test on Form M. W. 2003-A.

(c) Photographs of the defect or fracture and micro-photographs of the interior structure.

(d) A complete written analysis or deduction from the study of the above information.

We further recommend that blank No. 2003-A be incorporated in the Manual of Recommended Practice.

Drop Testing Machine.

Your committee considers that a uniform system of testing at the mills is essential. The following specifications for a standard drop testing machine were submitted by letter ballot to this association:

SPECIFICATIONS FOR DROP TESTING MACHINE.

A drop testing machine conforming essentially to the manufacturers' plans and specifications and in general accord with the following requirements will give satisfactory results:

(1) The machine shall be arranged to allow a 2,000-lb. tup to fall freely at least 25 ft. on the center of a rail resting on supports that can be adjusted to spans varying from 3 ft. to 4 ft. 6 in.

(2) The anvil shall be a solid casting, weighing, with the attachments that move with it, 20,000 lbs. It shall be free to move vertically independently of the lead columns and shall be supported on 20 springs known as the standard "C" spring, without center coil, as employed by the Master Car Builders' Association (their figure 5614). This spring has a free length of 8¼ in., an outside diameter of 5 7-16 in., and is made from a bar having a diameter of 1 3-16 in. These springs are to be arranged in groups of five at each corner of the anvil and are to be held in place by hubs raised on the top of the base plate and by circular pockets on the underside of the anvil. Removable finished steel wearing strips shall be secured to the anvil and the lead supports for guiding the vertical movement of the anvil.

(3) The base plate shall be of cast-iron or cast steel 8 in. thick in the area covered by the anvil. It shall be firmly secured to the substructure by four bolts 2 in. in diameter.

(4) The substructure shall consist of a timber grillage resting on a masonry foundation. The grillage shall project 9 in. beyond the ends of the base plate, and clear the columns at the side. It shall consist of one course of 12 in. by 12 in. sound oak or southern yellow pine, preferably creosoted, laid close and well bolted together. The masonry, preferably concrete, shall be not less than 5 ft. deep below the grillage and be suitably supported on the subsoil.

(5) The pedestals for supporting the test rail shall be substantial castings. The rail supports shall be removable pieces of steel, securely held in the pedestals, having an upper cylindrical bearing surface, with a radius of 5 in. The pedestals shall be adjustable to spans varying from 3 ft. minimum to 4 ft. 6 in. maximum between centers. They shall be securely held together, and so fixed to the anvil as to insure that the center of span shall always coincide with the center between leads.

(6) The leads shall be firmly connected to the base plate and well braced. They shall be long enough to provide the prescribed free fall of the tup. They shall be provided with a convenient ladder and a plainly marked gage, divided into one-foot intervals. The zero of this gage shall be 5¼ in. above the top of the rail supports, and the specified height of drop shall be measured from this zero irrespective of the height of rail being tested. One of the guides shall have a removable section 6 ft. long at the bottom, so that the tup or tripping block can be readily removed.

(7) The tup shall weigh, with the accessories that drop with it, 2,000 lbs. The striking die shall be steel, having a cylindrical striking face, with radius of 5 in. and a length of 12 in. The guide grooves shall have finished surfaces. The tripping head shall allow a grip of the tongs that will release at the exact height for which the tripping device is set, and that will be safe from accidental release while the test piece is being shifted.

(8) The tongs and tripping device shall be arranged to release the tup automatically only; no manual releasing will be allowed. The tripping device shall be easily adjustable at one foot intervals.

CONCLUSIONS.

The following conclusions were adopted at the March, 1909, convention:

(1) That the complete set of rail statistic blanks, previously described and approved by letter-ballot, be used by the members of the association for reporting and compiling information relative to rail failures and rail service.

(2) That Form 2004-A, summary of steel rail figures for six months, compared with the same period of previous year; Form 2004-D, position in ingot of steel rails which failed, and Form 2005-D, record of comparative wear of special rail, be adopted by the association as approved forms for receiving statistics for the quantitative study of rail failures.

(3) That the members of the association furnish the rail committee with reports of studies of individual rail failures or rail service, from time to time, as soon as such studies have been made.

(4) That Form M. W. 2003-A, heretofore submitted, be adopted as a standard form of the association for receiving reports of the chemical analysis and physical tests of individual rails.

(5) That a complete report of the study of an individual rail should consist of—

(a) Copy of the track foreman's report on Form M. W. 2002-A, after being checked by an engineer.

(b) Results of chemical analysis and physical test on Form M. W. 2003-A.

(c) Photographs of the defect or fracture and micro-photographs of the interior structure.

(d) A complete written analysis or deduction from the study of the above information.

(6) That the blanks described above and approved by your association by letter-ballot, also blank 2003-A, be added to the Manual of Recommended Practice.

(7) That the specifications and plan for drop testing machine, herewith submitted to the association for letter-ballot, be adopted as standard.

(8) That the specifications and plan for drop testing machine be added to the Manual of Recommended Practice.

(9) That the specifications for Bessemer steel rail, as presented in the Manual of Recommended Practice, be allowed to remain in the manual as now printed.

(10) That the following note be added to the specifications in the manual: "The committee on rail has under consideration the matter of revised specifications."

Track

Committee No. 5

The results of the track committee's work were excellent. Recommendations and conclusions are presented herewith.

STANDARD FLANGEWAY (ADOPTED).

Your committee has held conferences with joint committees of the American Railway Master Mechanics' and Master Car Builders' Associations during the year and as a result begs to recommend the following resolution:

Resolved, That the clear width of standard flangeway for all frogs and between main rails and guard rails be 1¾ in., measured at the gage line, for all tracks of standard gage.

A drawing shows position of wheels with maximum and standard flanges with reference to 1⅞ in. throatway and for 1¾ in. throatway. The meeting with the wheel committee of the Master Car Builders' Association brought out the fact that some changes were necessary in the M. C. B. standard reference gage as used for mounting. The corrected gage is shown on the drawing.

WIDE GAGE.

Report on whether wide gage, which is due to worn rail, should be corrected by closing in or replacing the rail.

After careful consideration of the above subject, your committee begs to report as follows:

Wide gage, due to worn rail, within the safe limits of wear, need not be corrected until the excess over the gage is equal to or exceeds ½ in., and should then be corrected by closing in.

SPIKING.

Consider revision of paragraph (3), under "Proper Method of Spiking," Manual, 1907, p. 64, and report recommendation as to extent gage on curves should be worn open before closing in is necessary.

Your committee recommends that the following paragraph be substituted for the one now appearing in the Manual (the change consisting of the substitution of "½ in." for "⅜ in."):

(3) Within proper limits a slight variation of the gage from standard is not seriously objectionable, provided the variation is uniform and constant over long distances. Under ordinary conditions it is not necessary to regage track if the increase in gage has not amounted to more than ½ in., provided such increase is uniform.

MAINTENANCE OF LINE AND ALIGNMENT (ADOPTED).

Adjustment of curves with consideration as to easement curves:

Easement curves should be used on all curves requiring an elevation of 2 in. or more.

The choice of easement curves should be governed by the ultimate possibilities as to speed, with consideration as to probable revision of the worst features of alignment, rather than by existing schedule speed.

On curves of 6 deg. and over, which are limiting curves as to speed, easement curves not less than 240 ft. long should be used.

On curves of less than 6 deg. which are limiting curves as to speed, easement curves should be used whose length in feet is not less than 5⅓ times the speed in miles per hour calculated for an elevation of 8 in.

On curves which are not limiting curves as to speed, easement curves should be used whose length in feet, when the rail is elevated for the ultimate speed, will be not less than thirty times the elevation in inches nor less than two-thirds the ultimate speed in miles per hour times the elevation in inches.

Longer easement curves than the minimum lengths recommended may be used to advantage and often with increased convenience in their application, but any considerable increase in length is wholly unnecessary and should never be made without careful consideration as to the effect on cost. The

minimum length should be used in all cases where a greater length would adversely affect the degree of curve.

Easement curves should be used between curves of different degree in the same way that they are used between curves and tangents.

The curve elevation should be run out in the same distance as the length of easement curve, with no elevation on tangent and full elevation on the circular curve.

Any form of easement curve is satisfactory in which the degree of curve increases with the distance; in which the rate of increase in degree of curve can readily be changed to suit each particular case, so that the length of easement curve shall be the same as the distance in which the outer rail is raised from zero to full elecation; which can be run in by deflection or offset, with chords of any desired length, and which is of the general type of Searles, Crandall, Holbrook, Talbot or cubic parabola.

Conclusions (adopted).

Your committee recommends the adoption of the following conclusions:

(1) That the formulas for the functions of the split switch proposed be approved as good practice.

(2) That the properties of the frogs and switch rails given in the accompanying tables be approved as good practice.

(3) That the degree of curve be defined as the angle subtended by a 100 ft. chord.

(4) That all curves be spiraled which would require 2 in. elevation for the highest permissable speed.

(5) That wide gage, due to worn rail, within the safe limits of wear, need not be corrected until the excess over the gage is equal to or exceeds ½ in., and that it should then be corrected by closing in.

(6) That paragraph (b), page 60, of the Manual, under the heading of Maintenance of Line and Alignment, be withdrawn and the version submitted in the body of this report substituted.

Injury to Signal Equipment, Brine Dripping From Refrigerator Cars

Special Committee

The report of this special committee was discussed thoroughly. It was decided not to recommend that brine drippings be deposited in the center of track inasmuch as it would not protect bridges or relieve the signal situation because of insulation resistance between rails. The following data was contained in the report:

CHICAGO, BURLINGTON & QUINCY.

Bridges.—On lines not exposed to refrigerator traffic, the paint on bridges will last on the average four years and remain in good condition. On lines which are exposed to refrigerator traffic, the iron work on the stringers and floor beams of bridges begins to show "pitting" when protected only by oil paint within a few months after being painted. The cost of cleaning and painting a floor system will average not less than 25 cents per linear foot of bridge. It has been found that certain paints will last about one year, so that the cost on account of brine is estimated at 25 cents per foot per year. There are 150,000 ft. of iron bridge exposed to refrigerator traffic on the system, so that the annual cost of brine drippings on bridges only amounts to $37,500, which is interest on $750,000.

Track.—The deterioration of the plates, angle bars and the rail itself on tracks exposed is, in a great many places, extremely marked. Angle bars have been reduced ⅛ in. at the edge of the lower angle, and tie plates reduced so that nothing was left but the ribs, which were pressed into the wood. This represents a deterioration during less than ten years, the original thickness of the plates being ⅜ in.

MICHIGAN CENTRAL.

Track.—On 545 miles of eastbound track it is estimated that the loss to rails during their life is about 10 per cent, and the effect on bolts, spikes and tie plates, which require more frequent renewals than the same items on westbound track, which is not affected by the brine drippings, is 50 per cent. On this basis we have the following figures chargeable to brine drippings:

Bolts	$ 9,800
Tie plates	27,000
Spikes	8,000
Rails	12,700
Angle bars	1,500
Labor	50,000

Bridges.—The bridge department estimates that the increased cost of painting and more rapid deterioration of bridges amounts to $25,000 per year.

To this is added $4,000 per year, because of increased number of track sections, increased amount of battery and the cost of extra maintenance because of these increases, making a total yearly cost of $145,000, which is the interest on $2,900,000.

Signals.—The signal department report details additional cost as follows:

Maintenance of 91 track sections of the eastbound track above the number of sections used on the westbound track	$ 455
1,000 cells of battery	1,700
Extra labor and attendance	100
Labor and material for more frequent bonding and adding third wire	1,000
Extra amount of labor and material for interlocking fittings, connections, cross pipes, etc.	350
Labor of cleaning tracks	395
Total	$4,000

LAKE SHORE & MICHIGAN SOUTHERN.

The additional cost on account of brine drippings from refrigerator cars on track circuits is as follows: Toledo District, $301; Michigan District, $100; Eastern District, $85, making a total for added battery of 486. To this should be added the cost of additional maintenance. It has also been found that the fiber in insulated joints on the eastbound track requires renewal oftener than the westbound and the estimated cost on this account is $1,500 per year.

The few statements above quoted are representative of existing conditions wherever refrigerator traffic is handled, and indicate only a portion of the enormous total expense incurred by railroads handling this class of traffic in repairing damage to signal equipment, bridges and track due to brine drippings. In addition to the maintenance of way departments directly affected, there are a number of other items not easily obtainable because somewhat indeterminate; for example, (a) the additional cost for repairs and maintenance of rolling stock; (b) the cost of trains stopped at automatic signals that have failed to operate due to brine drippings; (c) the extra cost for the up-keep of interlocking apparatus, both mechanical and electrical; and the failures and consequent train delays on account of the reduction of the insulating resistances; (d) electrified sections of railroads, using third rail to furnish the current for traction, will find that drippings from refrigerator cars as now arranged will fall on the third rail. This will of course cause rapid deterioration of the rail and rail supports; it will reduce the insulation resistance between third rail and ground, and consequently add to the power station output, add to any electrolytic action that causes damage, and reduce the factor of safety provided for against accidents to person working about the third rail.

CONCLUSION.

Your special committee is of the opinion that the damage to railroad equipment, and especially to maintenance of way equipment, and the failures of signaling and interlocking apparatus, caused by the present practice of allowing brine to drip

from refrigerator cars en route is of such vital importance in operating costs as to call for immediate action on the part of this association, and we recommend that this association formally request the American Railway Association to take such action as will stop the dripping of brine.

Buildings

Committee No. 6

The committee recommended the following paragraph as a substitute for conclusion (2) in the Manual, but same was not adopted.

"Under ordinary conditions the reinforced concrete roof is the most desirable for a roundhouse, because of the greater security afforded by it against interruption to traffic through damage to the roundhouse and its contents and because of its economy."

We would recommend the revision of conclusion (3) to read as follows:

"When the roof is of reinforced concrete the columns and roof beams should be of the same material."

We would recommend the revision of conclusion (4) by the addition of the word "considerably" after the word "cost" in the second line, making it read as follows:

"Reinforced concrete should be used for the walls only where special conditions reduce the cost considerably below that of brick or plain concrete and where plaster is not considered satisfactory." (Adopted.)

Your committee recommends the adoption of the following conclusions as a substitute for recommendation No. 11, page 68, in the Manual:

CONCLUSIONS. (ADOPTED.)

(1) Heat should be concentrated at pits.

(2) General temperature of the engine house should be kept between 50 and 60 deg.

(3) The best method for heating engine houses is by hot air driven by fans through permanent ducts (under the floor where practicable). The supply should be taken from the exterior of the building (no recirculation should be allowed). The air should be delivered to the pits under the engine portion of the locomotive. Air to be heated as far as may be by exhaust steam, supplemented as required by live steam.

CONCLUSIONS. (ADOPTED.)

(1) When practicable, oil houses should be isolated from the other buildings at a terminal.

(2) Oil houses should be fireproof and the storage in large houses should be preferably either underground or in the basement.

(3) Oils that are stored in sufficient quantities should be delivered to the tanks in the house direct from tank cars. For oils that are stored only in small quantities provision should be made for delivery to storage tanks from barrels by pipes through the floor.

(4) The delivery system from the storage tanks to the faucets should be such that the oil can be delivered quickly and measured. The delivery should also be such that there will be a minimum of dripping at the faucet and that the drippings be drained back to the storage tanks.

CONCLUSIONS.

The following conclusions were not adopted, but recommendation No. 8, page 68, in the Manual and the paragraph on Smoke Jacks, page 70, of the Manual, will be stricken out.

Smoke removal should be separately provided for by the use of jacks, and the currents produced in the jacks should be utilized for aiding ventilation in the house by drawing air from the top of the house through annular openings leading into the top of the jack. Jacks should be without dampers, fixed, and preferably built of non-corrosive material with cross-section not less than 30 in. in diameter. They should be of smooth material, circular in section above the hood, and extending well above the roof line; care in design should be taken to avoid any corners. The hood of a jack should have a minimum length of 10 ft. so as to permit variation of location of an engine on the pit. The bottom of the jack should be as low as the engines served will allow and it should be furnished with a drip trough; the slope upward should be gradual to the flue.

We recommend that our conclusion in regard to jacks be substituted for recommendation No. 8, page 68, in the Manual, and that the paragraph on Smoke Jacks, page 70, of the Manual, be stricken out.

Wooden Bridges and Trestles

Committee No. 7

After several amendments were made to the specifications, which are printed in Bulletin No. 107 of the association, the following conclusions were adopted:

(1) That the standard specifications for bridge and trestle timbers be approved as good practice.

(2) That it is preferable to make the inspection of bridge and trestle timbers at the mills.

(3) That the revised specifications for timber piles be approved.

(4) That the list of safe unit stresses for structural timber be approved.

Signs, Fences, Crossings and Cattleguards

Committee No. 9

Your committee submits the following for approval and addition to the Manual of Recommended Practice under the head of "Gates for Right-of-Way Fences."

The width of farm gates should be from 12 to 16 ft., depending upon the size of agricultural machinery in use in the vicinity, or as required by the laws of the states through which the railway may pass. The minimum height of farm gates should be 4 ft. 6 in. from the surface of the roadway.

Farm gates should be hung so as to openaway from the track, and, if hinged, swing shut by gravity.

CONCLUSIONS.

Your committee recommends the adoption of the following conclusions for publication in the Manual of Recommended Practice:

(1) That the recommendation under farm gates be approved as good practice.

(2) That the recommendations as to construction of highway grade crossings be approved as good practice.

(3) That the recommendations as to snow fences, snow sheds, flanges, snow plows, etc., be approved as good practice.

(4) That the recommendations as to concrete fence posts be approved as good practice.

The above conclusions were adopted with the understanding that the detailed recommendations referred to be reduced to a statement of principles.

The Proper Construction of Grade Crossings.

Owing to the well-known difficulty of maintaining the track in proper surface through and adjacent to grade crossings, a form of construction should be adopted that will tend to remedy this trouble by requiring a minimum amount of labor and material to be expended in repairs or renewals.

This construction will necessarily vary with conditions, but can be divided into the following general classes:

(1) Crossings where paving is required to conform to street specifications.

(2) Crossings of streets where no paving is required.

(3) Crossings of public roads or highways outside of towns or cities.

(4) Crossings of private or farm roads.

(1) For crossings where paving is required to conform to street specifications, cross-ties should be treated chemically to

prolong their life to the greatest limit possible, and laid on a bed of stone or slag ballast, not less than twelve (12) in. in depth, placed in three (3) in. layers, each thoroughly rammed so as to prevent settlage. An eight (8) in. bed of Portland concrete mixed 1-3-6 can be substituted for the ballast if desired.

With the ballast and outside of the tracks, porous tile drains not less than six (6) in. should be placed at intervals, leading to the nearest point from which efficient drainage can be obtained.

The support of the rail on the ties will vary with the character of paving used.

If stone blocks are used, a substantial cast or malleable steel chair, with a base of not less than 48 sq. in., should be provided, fastened to the tie with suitable lag-screws, the rail fastenings to be a hook-headed bolt secured with nuts. Ties should be spaced so as to allow the joints to be supported by these chairs.

On long stretches of track laid in streets paved with stone blocks, the use of a special rail section, not less than 9 in. in depth, is advisable, to avoid the use of the chairs mentioned; with such a rail, heavy tie-plates should be used as a protection.

On the outside of the rail, the block paving should be laid up to the rail-head, but left slightly below it on the inside. An old rail or a suitable form of rolled filler should be placed to provide a flangeway, this to be fitted into the space between the head and base of the track rail: if an old rail is used the flange should be placed as nearly vertical as possible, the paving between the rails to be limited by the flanges or fillers. The flangeway should be supported by the same chairs carrying the track rail, with a clear opening of not less than 2 in.

Where a special rail section is used, the flangeway should be rolled as a part of it.

With vitrified or paving brick, the ties should be similar and have the same foundation as described above, except that with rails of high section the use of the cast chairs is unnecessary.

A heavy tie-plate should be placed on each tie where the ordinary track rail is used.

A strip of treated timber 4 in. x 6 in., fitted to the rail and placed so as to expose 3 in. of surface next to the rail head, should be used next the outside rail, and this should be paved against; the strip should be ¼ in. below the rail head.

Metal flangeways should be provided as described above, and paved against in like manner.

With asphalt paving a similar construction as for vitrified brick is recommended.

Paving between and outside of the rails should be laid in the most approved and workmanlike manner.

(2) Street crossings where no paving is required should be divided into two classes—those with plank laid the entire width and length, and those with plank only next the rails and at the ends and filled between with suitable material.

For the first style, the plank should be of such timber as can be most economically obtained, not less than 3 in. in thickness, the outside planks to be shimmed, so as to be ¼ in. below the rail head, and those inside similarly shimmed when necessary.

An old rail laid on the side of some suitable form of rolled metal shape should be used as a flangeway, its ends to be slightly bent inward, so as to give an opening of not less than 4 in. at the ends, the flangeway through the balance of the crossing to be not less than 2 in.

The intermediate planking should be closely fitted to the base of the old rails or other metal forming the flangeway, so as to avoid the necessity of further securing them to the ties.

For fastening the planking to the ties, ⅜ in. x 8 in. cut spikes should be used for rails 5 in. in height and under.

The ends of the planking should be beveled both between and outside the rails to a thickness of 1 in., commencing at a point 10 in. from the end.

One plank not less than 10 in. in width should be used on the outside of the track rails, and the total length of the planking should conform to the required street width.

Concrete, slag or other suitable material should be used from the plank outside of the rails to such distance necessary to properly complete the crossing.

Where the requirements do not call for continuous planking over the tracks, one plank should be placed each side of each rail, with the flangeway rails or metal shapes as described above and similar in other details, with the exception that a filling of concrete, slag, gravel or other suitable material should be used between the planks, the material to be filled in level with the top of the planking after a thorough compacting.

In the description of street crossings for cities and towns, no limits as to approach grades are given, such physical characteristics being governed by local laws and conditions. The width of the street crossings are also governed by local requirements.

(3) For public roads and highways outside of towns and cities, the crossing construction should be similar to that described for streets which have the minimum amount of planking and ballast filling between them. Such crossings should be level for a distance of 5 ft. on each side of the outside planks; on a fill, the approach grade should not exceed 6 per cent.

Where the crossings are in a cut, the ditch drainage should be provided for by the use of terra cotta pipe where feasible, but if the volume of water is too great, box culverts or bridges of similar width to the crossing should be provided.

The width of highway crossings should not be less than 16 ft.

(4) Crossings of farm or private roads should be constructed by filling with ballast or other suitable material level with the railhead, on the outside and inside, leaving a proper flangeway inside the rails. Such crossings should be level for not less than 3 ft. each side of the rails, and the approach grades should not exceed 8 per cent.

In cuts, proper provision should be made for drainage as for highway crossings.

The width of farm or private road crossings should be not less than 12 ft.

Conclusions and Recommendations.

SNOW FENCE.

Snow is carried by the wind close to the surface of the ground and is deposited in railway cuts on account of the eddies which these cuttings cause in the wind. The function of the snow fence is to form artificial eddies on the windward side of the cut at sufficient distance to cause the snow to deposit between the snow fence and the cut.

The location of the drift or eddy depends upon the form of the fence. A tight fence of sufficient height will cause the snow to accumulate on the windward side of the fence; an open fence causes the snow to accumulate principally on the leeward side. The distance between the fence and the drift depends upon the height of the fence, the width of the openings between the boards, the velocity of the wind and the character of the snow.

The character of the snow fence and its location for the protection of a given point depends largely upon local conditions, some of which can only be determined by experiment, and for this purpose portable snow fence is recommended. Where local conditions admit, a permanent snow fence located on the right-of-way fence line is most economical.

If permanent wooden fences are used, the boards should be laid close, where the right-of-way is 50 ft. or less from the center of the track; for greater distances space should be provided between the boards, and at 100 ft. distance, 50 per cent of the fence should be open space. The height of permanent board fence depends upon the probable amount of snow. The maximum height, however, should be 10 ft.

In most cases local conditions require the use of a portable snow fence. These fences are usually erected in the fields adjoining the right-of-way. They should be set on the windward side of the track at right angles to the prevailing winds and, to provide for variations in the direction of the wind, it is some-

times necessary to set the panels in crescent form. For ordinary conditions one line of fence is sufficient. The quantity of snow sometimes requires the use of three or four lines of portable snow fences set parallel and spaced about 100 ft. apart. These fences should be removed in the spring so as not to interfere with farming operations.

Hedge fences should be used where the quantity of snow is not too great, and where local conditions, including the economic feature, admit. Properly maintained hedge fences are effective in beautifying the right-of-way.

Stone walls should be used for snow fences where suitable stones for dry masonry walls are delivered free to the railway company by the adjoining property owners.

Temporary snow fences should be constructed of ties, laid in the form of worm fences.

MISCELLANEOUS METHODS.

Railways constructed in northern countries should have the track raised about 2 ft. above the general level of the ground, and for cuttings less than 4 ft. A flat slope of 4 to 1 should be given to both sides of the cutting.

In construction of new railways, or in grade revision, or trestle filling on existing railways in snow districts, the material should be taken from the sides of the cuttings. A steam shovel cut on each side is most effective in providing a place for snow to accumulate for ordinary snow conditions for cuttings up to 20 ft. in depth.

Salt should be used on switches only during the portion of the winter when the snow melts in daytime and freezes at night.

Where exhaust steam is available it should be carried about 12 in. beneath the surface of the ground at points where the accumulation of the ice requires frequent removal during the winter.

SNOW PLOWS.

Rotary snow plows are necessary for quick removal of snow where the depth of the drift exceeds 6 ft. and its length exceeds 30 ft., or where the natural snowfall has filled deep cuttings which the push plow cannot remove. Rotary snow plows are sometimes used to advantage in the removal of snow slides in mountain districts.

Push plows should be used for a level fall of snow and minor drifts, whenever the depth is too great to be removed by snow flangers. Snow flangers should be used for the removal of snow whose depth is less than 6 in. over the top of the rail.

SNOW SHEDS.

Snow sheds are expensive to construct and expensive to maintain, and the railway should be located, if possible, so as to prevent the necessity of their construction. Their use should be confined to localities which require protection from mountain snow slides, and then they should be constructed of more permanent material than is now ordinarily used.

Concrete Fence Posts

From observation of concrete fence posts your committee considers that the concrete post will heave very little or not at all, as posts set from two to five years ago are at present in almost perfect alignment, and not a loose or broken post was found. They appear sufficiently strong for all practical purposes after being properly cured and set. The claim that concrete posts reinforced with steel form lightning protectors appears reasonable. They will, of course, resist the action of fire and decay. They will not float and cannot be displaced so easily as wood posts. On the other hand, concrete posts must be carefully handled in loading and unloading and well cured before using. Fence wire in contact with their surfaces should be well galvanized.

The concrete post is much heavier than the wood post and the cost of distributing and setting is about 25 per cent greater.

It would seem that the concrete post is particularly adapted to railroad use. Most of the post machines are cheap and portable and the materials used are in daily use on all roads using concrete; the materials are cheap and easily obtained.

Signaling and Interlocking

Committee No. 10

A brief review of the work of the committee is here given, containing such conclusions as were reached at the convention.

Standard Interlocking Agreement.

In the form of a progress report a sub-committee presented a form of agreement for an interlocking at an existing crossing, class A. Forms for classes B and C, covering the crossing of a new line by an old one and of an entirely new crossing respectively, were not drawn up.

Of the conclusions, which follow, the first two were adopted as printed below, but the third was referred back to the committee because an agreement could not be reached upon it.

(1) That existing agreements should be given due consideration in the form of arbitraries in the division of construction, renewal, maintenance and operating expenses.

(2) That with existing situations the proper division of construction, renewal and maintenance expenses is on an operated-unit basis, each party paying for what is required to interlock its tracks, or the residue.

(3) The primary operating expense, or the residue after deducting such arbitraries as may be required by existing agreements, should be equally divided among the several parties interested. Where operating expenses are increased by facilities for the exclusive use of one party, such party for whose benefit such facilities are provided should pay the entire additional operating expense.

Specifications for Mechanical Interlocking.

These specifications were referred back to committee to prepare a specification for wrought iron pipe. Concerning interlocking protection of drawbridges the following recommendations were made by the committee:

SIGNALS.

Signals shall be provided for all routes approaching the draw and shall be located not less than 500 ft. from draw in direction of traffic, and 200 ft. from draw in reverse direction, unless State or Federal authorities prescribe otherwise.

High home signals with adequate approach information should be provided for current of traffic and dwarf signals for reverse and other routes approaching the draw.

LOCKING.

A locking arrangement shall be provided for each of the following purposes before signals can be cleared:

(a) To insure that the bridge is in proper alinement.

(b) To insure that all bridge surfacing devices are in their proper position.

(c) To lock each rail in proper position for train movement.

(d) To prevent the application of power for purpose of withdrawing bridge latch or opening draw.

Facing-Point Locks.

Regarding facing-point locks the following conclusions were reached by the committee:

NOTE:—Where bolt locks are used, the following requirements will apply:

(A) Home signals for unlimited speed routes shall be bolt locked with all facing derails, switches, and movable point frogs in the route governed.

(b) Home signals for limited speed routes shall be bolt locked with all facing derails, switches, and movable point frogs in the route governed as far as practicable.

(c) All facing derails shall be bolt locked with all signals governing over them.

(d) Bolt locks shall be so constructed that the signal bar shall pass through the notch in switch bar to insure that switch is set in proper position and shall not be capable of passing through other notches that may be cut in the switch bar.

(e) The connections to the bolt lock bars shall be adjustable.

(f) The length of notch in signal bar shall be one and

three-quarters (1¾) in. greater than the thickness of the switch bar. The length of the notch in the switch bar shall be five-sixteenths (5/16) in. greater than the thickness of the signal bar.

(g) The connections to signal bar in bolt lock shall be compensated where the changes due to temperature, spring and wear to connections, exceed the clearance of the notch in the signal bar.

NOTE—Where automatic substitutes for bolt locks are employed.

(h) Circuit controllers shall be connected to all movable facing points in unlimited, and limited, speed routes with circuit controllers on their respective operating levers controlling electric locks on facing point lock levers.

(i) Where semi-automatic or power signals are used, the controlling circuits may be broken through circuit controllers on all movable facing points over which the signal governs.

Specifications for Electric Interlocking.

The specifications, presented by the committee, were adopted by the Railway Signal Association and accepted as a progress report at this convention.

Rubber-Covered Wire.

The specifications for rubber-covered wire were adopted and ordered included in the Manual.

System of Uniform Signaling.

This report was accepted as a progress report. It included a development of the method of uniform signaling and standard designs for signal apparatus.

Uniform Rules

Committee No. 12

The rules, as given below, are printed with the amendments made at the March, 1909, convention and were thus adopted:

The following rules governing track foremen, bridge and building foremen, and signal foremen were submitted for approval:

Rules Governing Track Foremen, Bridge and Building Foremen, and Signal Foremen.

TRACK FOREMEN.

(1) Track Foremen shall report to and receive instructions from the .....(Title).....

(2) They shall be responsible for the proper inspection and safe condition of the track under their charge, and shall do no work thereon that will interfere with the safe passage of trains, except under proper protection.

(3) They must go over their sections, or send a reliable man, at least once a day to make a thorough inspection to see that the track, signals, culverts, bridges, fences, etc., are in safe condition.

(4) If the track or any bridge or culvert, in the judgment of the Track Foreman, is not safe, he must at once put out the proper signals to warn approaching trains and immediately notify the .....(Title)..... of its condition, and do all in his power to repair the defect.

(5) During heavy storms, whether by day or night, whereby the track, or any portion of the company's property, becomes liable to damage, foremen and trackmen must be on duty: and at such times they must go over their sections to make sure that the track is safe, taking danger signals with them.

(6) They must use constant care to see that all waterways are kept free from obstructions.

(7) They must have a copy of the current timetable, and be thoroughly familiar with the rules and regulations thereon, and with the time of trains over their sections. They must carefully observe signals displayed by all trains, and assure themselves before obstructing track that all trains and sections due have passed. No notice will be given of extra trains, and trackmen must protect themselves as prescribed by the Book of Rules. They must provide themselves with reliable watches, and, when possible, compare time daily with a standard clock or conductor's watch.

(8) In case of accident, they must at once render all assistance in their power, whether the accident occurs on their own or on others sections.

(9) They must permit no encroachment upon or occupancy of any portion of the company's right-of-way and station grounds, except by proper authority.

(10) They shall employ such men as the .....(Title)..... will direct, and see that they properly perform their duties. They must keep the required record of the time of their men and of the material used.

(11) They must keep a careful lookout for fires along the track, and prevent, if possible, the destruction of fences, wood or other material, and the spread of fire into adjoining fields. During dry weather they must not permit fires to be started unless they have sufficient force to keep them under control.

(12) They must keep the vicinity of all bridges and trestles cleared of all combustible material, such as chips, bark, dried grass, etc. They must keep bridge seats, tops of piers, and all readily accessible parts of such structures cleaned of all cinders and dirt. Where water barrels are furnished, they must keep them filled with water.

(13) They must limit the use of handcars to the service of the company; and they must not permit anyone except employes of the company engaged in the performance of duty to ride thereon, except by proper authority. They must not permit the running of hand or velocipede cars belonging to private parties over the tracks of the company, except by proper authority.

BRIDGE AND BUILDING FOREMEN.

(1) Bridge and building foremen shall report to and receive instructions from the .....(Title).....

(2) They shall be held responsible for the proper inspection and safe condition of the structures under their charge, and shall do no work thereon that will interfere with the safe passage of trains, except under proper protection.

(3) They must have a copy of the current timetable, and be thoroughly familiar with the rules and regulations thereon, and with the time of trains over their district. They must provide themselves with reliable watches, and, when possible, compare time daily with a standard clock or conductor's watch.

(4) They shall employ such men as the .....(Title)..... will direct, and must see that they properly perform their duties. They must keep the required record of the time of their men and of the material used.

SIGNAL FOREMEN.

(1) Signal foremen shall report to and receive instructions from the .....(Title).....

(2) They shall be responsible for the proper condition of signals and interlocking plants under their charge, and shall do no work thereon that will interfere with the safe passage of trains, except under proper protection.

(3) They must have a copy of the current timetable, and be thoroughly familiar with the rules and regulations thereon, and with the time of trains over their territory. They must provide themselves with reliable watches, and compare time daily with a standard clock or with conductors.

(4) They shall employ such men as the .....(Title)..... will direct, and must keep the required record of the time of their men and of the material used.

(5) In case of accident affecting any portion of the signal or interlocking apparatus under their charge, they must at once proceed to the spot with the men, tools and materials necessary to make repairs.

(6) They must investigate and report on the forms provided for the purpose all failures of signals and interlocking plants in their territory.

(7) They must not make any permanent changes in signals or interlocking plants without the authority of the signal engineer.

CONCLUSIONS.

(1) Your committee recommends the adoption of the additions to the "General Rules" for publication in the Manual of Recommended Practice.

(2) Your committee recommends the adoption of the Rules Governing Track Foremen, Bridge and Building Foremen, and Signal Foremen for publication in the Manual of Recommended Practice.

Records, Reports and Accounts

Committee No. 11

With certain amendments to forms and charts, the following conclusions were adopted:

CONVENTIONAL SIGNS.

(1) The committee recommends the adoption of the revised list of conventional signs.

TRACK CHART.

(1) The committee recommends the adoption of Form M. W. 1016 as revised.

TRACK MAPS.

(1) On track maps drawn to a scale of 1 in. equals 50 ft. or less, tracks should be represented exclusively by double lines.

(2) On track maps drawn to a scale of 1 in. equals 200 ft. or more, tracks should be represented exclusively by single lines.

(3) On track maps drawn to a scale of 1 in. equals 100 ft.

(a) On maps representing preliminary studies and designs of proposed track layouts, tracks should be represented by single lines, except that double lines may be used where considered necessary to show turnout details.

(b) On maps representing completed work, station plats and permanent records, tracks should be represented by double lines.

TIME BOOKS.

(1) The use of Form M. W. 1008, with the additional columns as shown for reporting time where it is practicable to use a daily time report.

(2) A change in the cover page of Form M. W. 1008 to permit the signature of the foreman and his supervising officer.

(3) The use, wherever possible, of a daily time report for all departments.

(4) The use of the form recommended for time book where the daily report is not used. (Forms M. W. 1109 and 1110.)

(5) The use of the form to represent a compilation of the record and distribution of time. (Form M. W. 1111.)

(6) The use of a system of time checking to guard against errors and fraud.

Yards and Terminals

Committee No. 14

The committee submitted a progress report which was accepted by the association. The operation of hump yards and the use of machinery for handling freight were considered chiefly in this report.

OPERATION OF HUMP YARDS.

The committee presented valuable information as to the details of methods of operation employed at a number of freight yards of the gravity type. There is little opportunity, however, for generalizing or drawing conclusions, owing to the varying local conditions. The matter is therefore presented as an appendix in convenient form for the information of those engaged in the design or operation of freight yards.

Two separate inquiries were made by the committee: First, as to the methods of operating hump yards (noted above); second, as to the number of yards of this type in use or contemplated. From the replies to the latter series a table has been compiled showing 82 such yards in use.

It may be noted that there is a preponderance of opinion in favor of placing track scales on the hump. The location varies from 30 ft. to 300 ft. below the summit.

Some advantages of using two scales are also pointed out. They enable separate parallel tracks to be built for summer and winter conditions(and also allow the regular work to continue while one of the scales is under repair. But two parallel humps cannot be used at one time in connection with one classification yard, and to provide an additional or alternate hump for use in emergencies entails a loss of room and distortions of lines in both. There is, therefore, a reasonable doubt as to the value of such installations. At principal gateways of movement, and at points of origin of large volumes of freight of mixed character, and wide distribution the classification should be made, first (1) as to fast or slow movement, and second (2) as to destination.

The question is presented therefore as to the relative merits of the alternative plan of providing a second classification yard with the second hump to be used for fast freight, thus making it possible to take either hump out of service for a limited time without causing complete stoppage of classification, and making it possible to nearly double the classification capacity with a comparatively small increase in facilities. The second hump might be parallel with or tandem with the first, according to local conditions.

The relation of the percentage or proportion of cars to be weighed to the location of scales on the hump or elsewhere is not yet determined. We have testimony to the effect that the scale should not be located on the hump unless about 25 per cent of the car sto be handled must be weighed. We also have the opinions of men who are in charge of large hump yards that handle thousands of cars daily, that the scale should be located on the hump regardless of the number or proportion of the cars to be weighed. We assume therefore that the greatest economy would be secured by locating the scale on the hump if it is assured that from 5 to 10 per cent of the cars must be weighed.

Probably the most important matter for consideration in connection with the subject of prompt and economical handling of freight is proper classification as to character and destination. Therefore when high-class freight has been properly grouped it should not be again mixed with slow freight at a division terminal or point of divergence, but without mixing with freight of different character should be classified as to destination only in preparation for further movement.

We do not need to omit scales from humps on account of loss of efficiency caused by their installation, but we do need generally better yard design, steeper grades between the summit of humps and the receiving ends of the classification tracks, and better facilities for the return of car riders.

In hump yards in which the grade approaching the hump is heavy the cost of operation is excessive because a large amount of power is required to get the cars to the summit. In some cases very large engines are used. In other cases two large engines are coupled, and in many cases trains that were hauled into the yard with one engine are cut into two or more sections to be pushed over the hump.

In some cases the lack of room has caused heavy grades approaching a hump, with consequent increase in cost of operation, and in many places where lack of room has prevented gravity classification, it could be successfully employed if the cars could be handled promptly on approach grades that are too heavy for operation by locomotives.

It is thought that where more than one engine is required to push a train over the hump, or where the approach grades are too steep to be operated successfully or economically by locomotives, the question of substituting stationary power is worthy of consideration.

FREIGHT HANDLING AND CONVEYING MACHINERY.

The committee's inquiries in this direction have been mainly barren of practical results, and there appear to be no conveyors in use in ordinary freight houses. Inquiries sent to a large number of manufacturers of machinery of this kind have failed to bring to light a single installation, although several state that their machinery is applicable to the service. In a few cases, conveyors are used for loading and unloading cars at industrial establishments and at steamship piers. This latter case was considered in the 1908 report.

For handling heavy or bulky freight at yards, cranes are very generally used. These may be fixed jib cranes, or overhead cranes of different classes. The latter usually span one or more tracks and a driveway, so as to transfer the articles between cars and wagons. These may be classed as follows, the bridge in each case carrying a trolley hoist which travels upon it: (1) the bridge fixed; (2) the bridge traveling on an elevated runway; (3) the bridge carried by towers, which travel on surface tracks.

For handling freight in a warehouse, pier shed or freight house, the following systems may be used: (1) Conveyors (roller, chain, belt, platform, etc.); (2) overhead traveling cranes; (3) carrier systems.

Freight handling by machinery may be divided into two classes: First, in warehouses and steamship piers, where the movement is mainly longitudinal; second, in freight houses, where there are numerous movements in different directions. The former case is much the simpler, but it may be found practicable to introduce mechanical handling, so as to reduce the amount of trucking in the latter case.

Iron and Steel Structures

Committee No. 15

This committee presented a report on the maintenance of bridges, including protection from corrosion, which will be revised after written criticisms are given and then presented for publication in the Manual.

Water Service

Committee No. 13

Conclusions in regard to the general principle of water supply were submitted by the committee. They were amended in certain particulars and other parts were referred back to the committee for final revision. The conclusions covered the following subjects:

Supply quantity; supply source; pumping plants; methods of delivery to locomotives, covering function of water station and storage tanks; specification for 50,000 gallon white pine tubs; steel storage tanks; tub unit capacity; water columns, and operation.

The specifications for white pine tubs are to be revised and reference is not to be made to any given capacity.

Wood Preservation

Committee No. 17

The following specifications for coal-tar creosote and for zinc chloride were adopted by the association:

STANDARD SPECIFICATION FOR COAL-TAR CREOSOTE.

The oil used shall be the best obtainable grade of coal-tar creosote; that is, it must be a pure product of coal-tar distillation and mnust be free from admixture of oils, other tars or substances foreignu to pure coal tar; it must be completely liquid at 38 deg. C., and must be free from suspended matter; the specific gravity of the oil at 38 deg. C. must be at least 1.03. When distilled according to the common method, that is, using an 8 oz. retort, asbestos covered, with standard thermometers, bulb ½ in. above the surface of the oil, the creosote, calculated on the basis of the dry oil, shall give no distillate below 200 deg. C., not more than 5 per cent below 210 deg. C., not more than 25 per cent below 235 deg. C., and the residue above 355 deg. C., if it exceeds 5 per cent in quantity, must be soft. The oil shall not contain more than 3 per cent water.

SPECIFICATION FOR ZINC-CHLORIDE.

The zinc-chloride used shall be as free from any impurities of any kind as is practicable, being slightly basic and free from free acid.

CONCLUSIONS.

The following conclusions were adopted:

(1) Coal-tar creosote and zinc chloride are efficient preservatives when properly applied and when used under proper conditions.

(2) It is necessary to keep better records than have been kept so far in order to form proper conclusions as to the merit of different methods and processes.

(3) Preserved wood may be destroyed by mechanical action long before it is decayed.

(4) The specification as given for coal-tar creosote is good practice and should be adopted.

(5) There should be a standard temperature at which coal-tar creosote is measured. The temperature of 100 deg. F. as given in the report is recommended.

(6) It is essential that timber should be properly grouped in order that a successful treatment may be obtained. The species, proportion of heartwood and sapwood, condition of the timber with respect to its moisture content, and the wood structure, will in general determine this grouping.

(7) It is desirable to air-season timber in order to prepare it for treatment. Most woods can be best treated after being air-seasoned.

Trade Notes

A bulletin on rural line construction (No. 45) recently issued by the Kellogg Switchboard & Supply Co., Chicago, Ill., will prove of interest at this time to telephone men who are interested on the subject. It is carefully illustrated showing the best practice in setting poles, guying, bracing and wiring. Explaining the different wind and other strains, and the importance of careful guying; gives transposition brackets, insulators, arms, arm braces, etc. Tools required in line and telephone work and costs. Also the forms and contracts, constitution, by-laws and rules of order generally used by farm companies. The bulletin will be sent promptly to those interested upon request.

The Detroit Graphite Company, paint makers, Detroit, Mich., has just issued a very neat and attractive booklet descriptive of the repainting of the Poughkeepsie bridge. This bridge is one of the longest in the world, and the enormity of the work in preparing the bridge, as well as the painting itself, is very attractively set forth. The book is one which every engineer should have in his possession, and the Detroit Graphite Company will cheerfully send same upon application.

Mr. William P. Henszey, a member of the firm of Burnham, Williams & Company, controllers of the Baldwin Locomotive Works, died March 23 at his home in Philadelphia. Mr. Henszey, who was 77 years old, had been connected with the firm for nearly 50 years. He was considered one of the foremost designers of locomotives in the country.

The Jeffrey Manufacturing Company, Columbus, Ohio, issued a new bulletin, No. 101, descriptive of the Jeffrey Lock-Jaw wrench, which is a simple and practical track wrench developed because of the demand for a wrench whose jaws would not spread.

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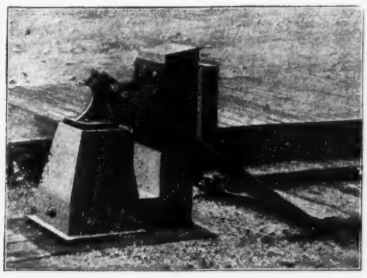

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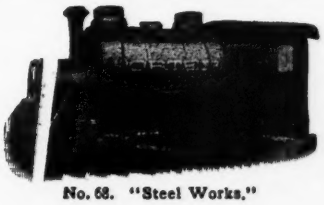

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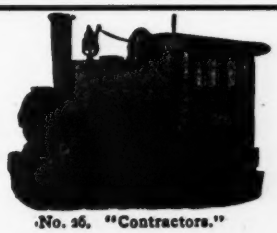

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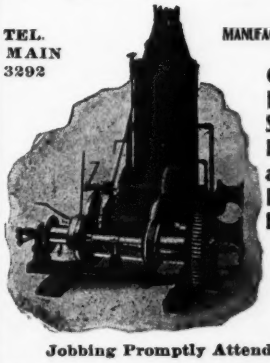

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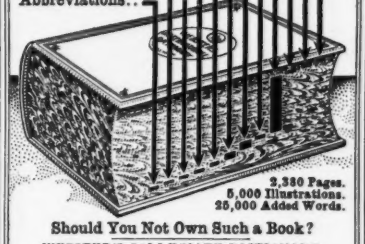

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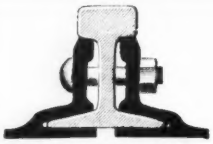

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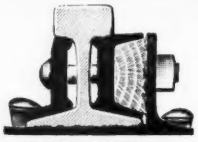

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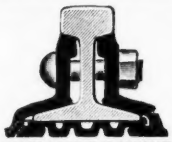

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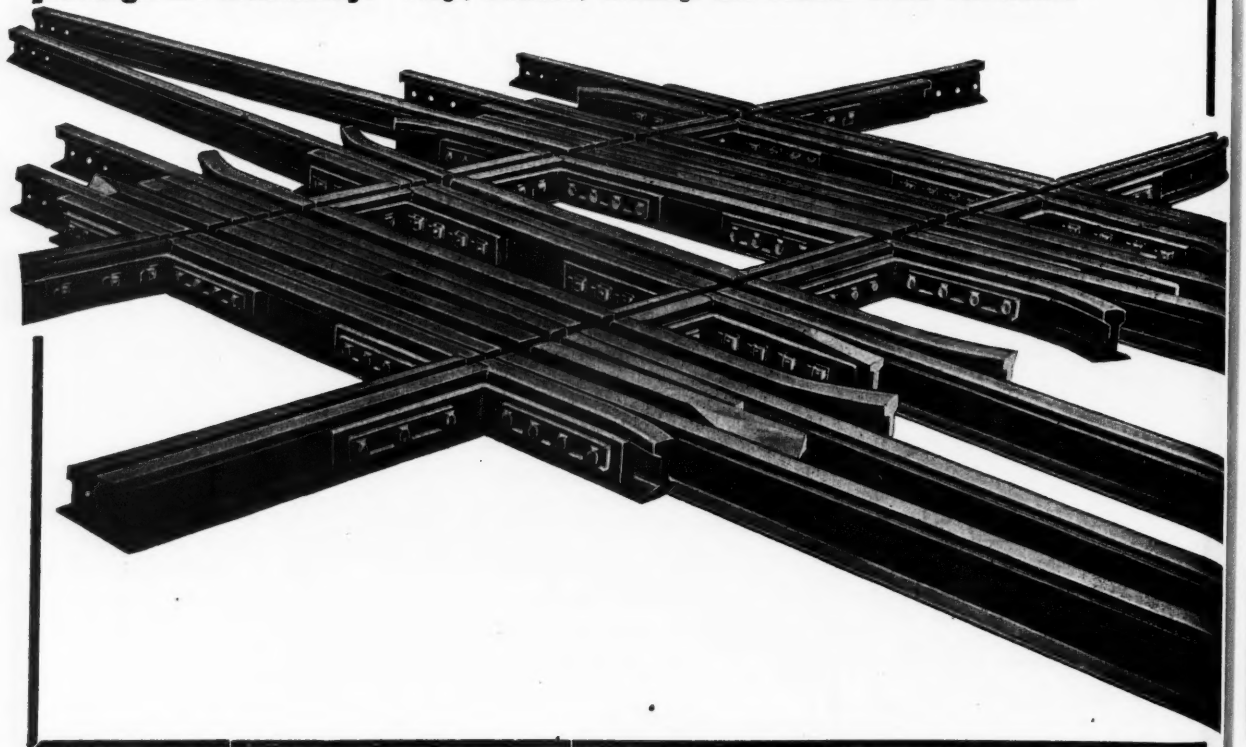

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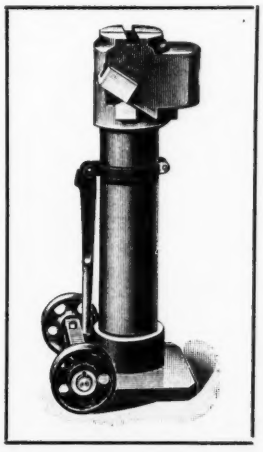

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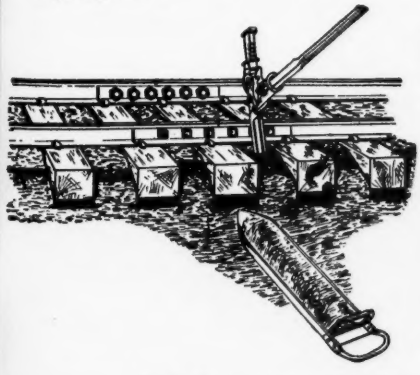

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FIG. 2—Showing pan removed, ballast under tie, and cleaner ready to be withdrawn.

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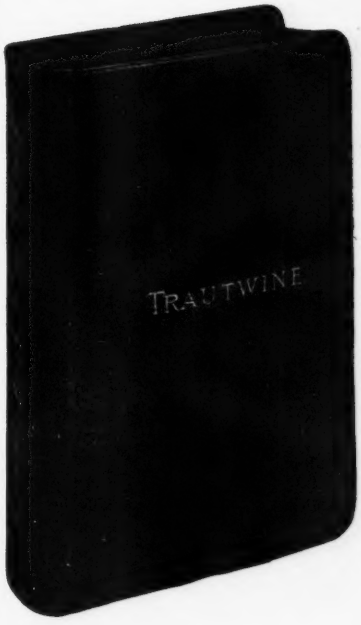

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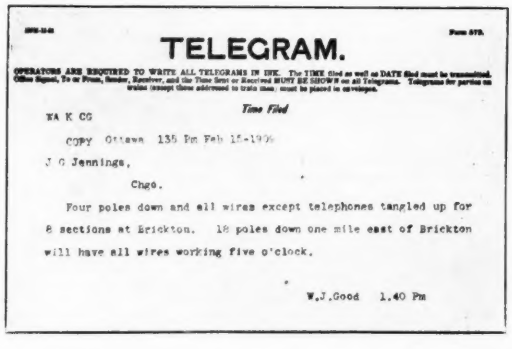

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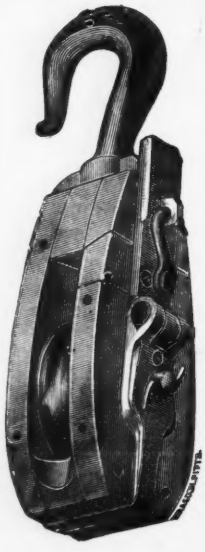

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